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PHYSICS ABSTRACTS

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SCIENCE ABSTRACTS—SECTION A

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The language of an original article is indicated after the decimal number, unless the article is in English, thus: = 3 German, = 4 French, = 5 Italian, = 6 Spanish, = 82 Russian, = 956 Japanese.

MATHEMATICS

333 512.831 : 621.3.012.8

Matrices, tensors or dyadics for studying electrical networks? REED, M. B. *J. Appl. Phys.*, 12, *pp.* 773–779, *Nov.*, 1941.—[Abstr. 225 B (1942)].

334 512.942

On the theory of non-linear direction displacements. MIKAMI, M. *Jap. J. Math.*, 17, *pp.* 541–568, *Aug.*, 1941.

335 512.98 = 3

Partially ordered algebra. NAKANO, H. *Jap. J. Math.*, 17, *pp.* 425–511, *Aug.*, 1941.

336 513.624

Some remarks occasioned by the geometry of the Veronese surface. EDGE, W. L. *Proc. Roy. Soc. Edinb.*, 61, 2, *pp.* 140–159, 1941.

337 513.813 = 4

On the theory of normal conformally connected spaces and Riemann's conformal space geometry. YANO, K., AND MUTÔ, Y. *J. Fac. Sci. Tokyo Univ.*, 4, 3, *pp.* 117–169, 1941.

338 513.814

Some properties of real linear topological spaces. BOURGIN, D. G. *Proc. Nat. Acad. Sci., Wash.*, 27, *pp.* 539–544, *Nov.*, 1941.

339 513.814

Metric conditions for symmetric Finsler spaces. BUSEMANN, H. *Proc. Nat. Acad. Sci., Wash.*, 27, *pp.* 533–535, *Nov.*, 1941.

340 517.2

Numerical differentiation near the limits of a difference table. BICKLEY, W. G., AND MILLER, J. C. P. *Phil. Mag.*, 33, *pp.* 1–14, *Jan.*, 1942.

341 517.43

On the Laplace transformation and Heaviside's operator *p*. KANNO, M. *Electrotechn. J.*, 5, *pp.* 79–80, *April*, 1941.

342 517.531

Theorems on interval functions and *h*-measures. KAMETANI, S. *Jap. J. Math.*, 17, *pp.* 533–539, *Aug.*, 1941.

343 517.544

On an extension of Löwner's lemma. KAWAKAMI, Y. *Jap. J. Math.*, 17, *pp.* 569–572, *Aug.*, 1941.

344 517.55 = 4

On the analytical functions of several variables. IV. Holomorphous and rationally convex regions. V. Cauchy's integral. OKA, K. *Jap. J. Math.*, 17, *pp.* 517–531, *Aug.*, 1941.

345 517.62

Expansions for a particular class of exponential-logarithmic integrals. ORR, W. J. C. *Proc. Camb. Phil. Soc.*, 38, *pp.* 34–39, *Jan.*, 1942.

346 517.63

On the Parseval formulae for Fourier transforms. EDMONDS, S. M. *Proc. Camb. Phil. Soc.*, 38, *pp.* 1–19, *Jan.*, 1942.

347 517.942.9

On certain expansions of the solutions of Mathieu's differential equation. ERDÉLYI, A. *Proc. Camb. Phil. Soc.*, 38, *pp.* 28–34, *Jan.*, 1942.

See Abstr. 400 518.3 : 532.73

348 518.4 = 3

Numerical differentiation of curves. SAUER, R., AND PÖSCH, H. *VDI [Z. Ver. dtsch. Ing.]*, 85, *pp.* 195–197, *Feb.* 22, 1941.—Instead of the usual graphical method, the authors recommend the use of a compensation line, obtained by the method of least squares, or a parabola or cubic. Methods of calculation are given. R. N.

349 518.43

Graphical methods for plotting time/speed/distance curves for railway trains. LIPETZ, A. I. *Trans. Amer. Soc. Mech. Engrs*, 63, *pp.* 603–613; *Disc.*, 613–615, *Oct.*, 1941.—Explains the Desdouits–Lomonossoff method of plotting speed/time curves and the Lipetz method of plotting speed/distance and time/distance curves. Two practical cases are worked out by the latter method, and checked very closely by the actual test runs. Details are fully given, but cannot usefully be abstracted. An extensive bibliography is appended. G. F. F.

350 518.6

The numerical solution of equations. WAIDELICH, D. L. *Elect. Engng, N.Y.*, 60, *pp.* 480–482, *Oct.*, 1941.—Four examples taken from chemical engineering, hydraulics, rectifier theory and telephone transmission, and including both simple and simultaneous equations involving various complicated functions of the unknowns, are solved by the Newton–Raphson method and by an iterative process. G. F. F.

351 519.1 : 541.183.2

The number of configurations of a co-operative assembly. MILLER, A. R. *Proc. Camb. Phil. Soc.*, 38, *pp.* 109–124, *Jan.*, 1942.—Formulae are found for the number of configurations of particles on 2- and 3-dimensional lattices when each particle (*a*) occupies 2 closest-neighbour sites, and (*b*) consists of 3 groups which occupy 3 sites on the lattice in such a way that adjacent groups in the molecule occupy closest-neighbour sites on the lattice. Bethe's method is used to determine the equilibrium conditions of the corresponding order-disorder problem, and the number of configurations is determined from these equilibrium conditions. For the case in which the molecules occupy 2 closest-neighbour sites on

the surface, the determination of the number of configurations from geometrical conditions is discussed.

352 519.2

On the reduction formulae for the incomplete probability integral of the multiple correlation coefficient of the second kind. BOSE, P. *Sci. and Cult.*, 7, *pp.* 171–172, *Sept.*, 1941.

353 519.24

The limiting form of Poisson's distribution. GUMBEL, E. J. *Phys. Rev.*, 60, *p.* 689, *Nov.* 1, 1941.

354 519.241

On some methods of random sampling in a region having some known characteristic. GHOSH, B. *Sci. and Cult.*, 7, *p.* 117, *Aug.*, 1941.

355 519.242.1 = 3

On a method of smoothing statistical series. ONO, K. *Jap. J. Math.*, 17, *pp.* 513–515, *Aug.*, 1941.

356 519.272

Correlation and time series. KOSAMBI, D. D. *Curr. Sci.*, 10, *pp.* 372–374, *Aug.*, 1941.

357 519.282

Range as a zoological character. SIMPSON, G. G. *Amer. J. Sci.*, 239, *pp.* 785–804, *Nov.*, 1941.—The difference between max. and min. observed values of a variate, defined as observed range, is commonly used in zoology and palaeontology as a measure of variation in species or other groups. In fact the range observed in a sample is not directly related to the range in a population and is never a valid estimate of the latter. The common procedure of comparing ranges observed in samples of different sizes is also incorrect and may be grossly misleading. Range is related in a complex way with the sizes of samples or populations and their standard deviations. In order to make ranges comparable with each other and to make them consistent estimates of a character of the population, it is necessary to estimate mean ranges for groups of some standard size, here proposed as 1 000. Methods for calculating such estimates, called standard ranges, are given, as well as tests of their reliability. Empirical study confirms their validity.

358 519.3 = 3

The direct methods of the calculus of variations as an aid to the engineer. SCHWANK, F. *VDI [Z. Ver. dtsch. Ing.]*, 84, *pp.* 313–317, *May* 11, 1940.—After a brief explanation of the principles, and the applications to boundary-value problems, the author deals with the method of Euler–Lagrange and Ritz's approximation method. The oscillations of a string and the deformation of a continuously loaded cantilever are given as examples. R. N.

359 519.42 = 3

On finite groups and sub-group links. IWASAWA, K. *J. Fac. Sci. Tokyo Univ.*, 4, 3, *pp.* 171–199, 1941.

360 519.44

On some modular properties of irreducible representations of symmetric groups. II. NAKAYAMA, T. *Jap. J. Math.*, 17, *pp.* 411–423, *Aug.*, 1941.

361 519.443

Infinite cycles and homologies. EILENBERG, S., AND MACLANE, S. *Proc. Nat. Acad. Sci., Wash.*, 27, *pp.* 535–539, *Nov.*, 1941.

362 519.5

Relations between concentrated sets and sets possessing property C. BESICOVITCH, A. S. *Proc. Camb. Phil. Soc.*, 38, *pp.* 20–23, *Jan.*, 1942.

363 519.5

A theorem on *s*-dimensional measure of sets of points. BESICOVITCH, A. S. *Proc. Camb. Phil. Soc.*, 38, *pp.* 24–27, *Jan.*, 1942.

ASTRONOMY

364 521.12

Why gravitation? NARLIKAR, V. V. *Curr. Sci.*, 10, *pp.* 434–435, *Oct.*, 1941.

365 521.153

Note on the origin of planets and satellites. LYTTLETON, R. A. *Mon. Not. Roy. Astr. Soc.*, 101, 7, *pp.* 349–353, 1941.

366 522.21

The Cassegrain telescope as a thick lens. PLUMMER, H. C. *Mon. Not. Roy. Astr. Soc.*, 101, 7, *pp.* 345–348, 1941.

See Abstr. 421 522.5 : 535.241.3

See Abstr. 446 523.51 : 535.375

367 523.6

Position of comets determined at the Royal Observatory, Cape of Good Hope, 1941, January-June. *Mon. Not. Roy. Astr. Soc.*, 101, 7, *pp.* 334–336, 1941.

368 523.61

Some notes on comet 1941c (de Kock). STOY, R. H. *Mon. Not. Roy. Astr. Soc.*, 101, 7, *pp.* 337–344, 1941.

See Abstr. 370 523.73 : 523.83

369 523.83

A critical examination of the Leander McCormick proper motions. ALI, A. *Mon. Not. Roy. Astr. Soc.*, 101, 7, *pp.* 317–323, 1941.—The distributions of McCormick proper motions in position angle for 3 groups are examined by assuming 3 absolute origins for each region. It is found that the frequency curves so obtained are very sensitive to the position of the absolute origin and that they vary very much from region to region for the same group. Although the two streams are on the whole shown, their analysis is heavily handicapped by the indeterminacy of the absolute origin. It is also established that in 6 galactic regions a common systematic error exists. In view of the fairly wide distribution of these regions, it is possible that this error may be common to all the galactic regions in the McCormick publication.

370 523.83 : 523.73

Solar motion and galactic rotation from O- and B-type stars. ALI, A. *Mon. Not. Roy. Astr. Soc.*, 101, 7, *pp.* 324–333, 1941.—The radial velocities of 788 early-type stars have been analysed for the K term, solar motion and galactic rotation. The stars were divided into 4 distance groups, taking into account the space absorption based on observational data. When solved for the individual distance groups, the K term does not seem to exist for the 3 relatively more distant groups but emerges with a value of $+ 3{\cdot}63 \pm 0{\cdot}44$ km./sec. in the nearest group. Assuming, however, that the solar motion vector is constant for the early-type stars in the different volumes of space surrounding the Sun and that a common K term characterizes it, we get a K term of $+ 2{\cdot}17 \pm 0{\cdot}40$ km./sec. with the solar velocity 20·07 km./sec. in the direction of $28°{\cdot}6 \pm 1°{\cdot}8$ in the galactic equator. This value of the K term is of the same order as the gravitational shift of the spectral lines towards the red, which is equivalent to about $+ 1{\cdot}6$ km./sec. for these massive stars and can therefore be identified with it.

371 523.872

The intensities of a triplet of SiIII in early-type spectra. ABDEL-RAHMAN, I. H. *Mon. Not. Roy. Astr. Soc.*, 101, 7, *pp.* 312–316, 1941.

372 523.874

Radial velocities and spectral line intensities for Iota Herculis. PETRIE, R. M., AND PETRIE, W. *Publ. Dom. Astrophys. Obs. Vict., B.C.*, 7, 10, *pp.* 189–197, 1941.—Fifty-two spectrograms of ι Herculis have been measured for radial velocity. A variation in velocity of 15 km./sec. is established and a short-period variation of the β Canis Majoris type is ruled out. Radial-velocity residuals for individual lines indicate the presence of Stark effect. Line profiles for Hγ, λ4 388 and λ4 471 of He I, and λ4 481 of Mg II have been derived and show no definite variation in absorption during an interval of nearly 5 hr.

373 523.874

The spectrographic orbital elements of H.D. 23277. PETRIE, R. M. *Publ. Dom. Astrophys. Obs. Vict., B.C.*, 7, 11, *pp.* 199–203, 1941.—The orbital elements of this system are determined from 36 high-dispersion spectrograms of which 28 showed the spectra of both components. The inclination of the orbital plane is low and from its value the absolute dimensions are computed.

374 526.1 = 3

Displacement of the North Pole since the carboniferous period. KÖPPEN, W. *Met. Z.*, 57, *pp.* 106–110, *March*, 1940.—The theories concerning the displacement of the North Pole are compared. According to Milankovitch [Abstr. 3606 (1934)] the path started from a point in the Pacific and went first E. and then N. in about a meridional line to the present position, while other investigators assume a path of 1 or 2 rather wide curves to the N.E. before the present position was reached. The positions of various points on the surface of the earth during the quaternary period, relative to present positions, are tabulated. The investigations are based on geological, palaeo-zoological and botanical researches in various regions. R. N.

375 529.78

Testing of timepieces. GOULD, R. E. *Circ. U.S. Bur. Stand. C* 432, [27 *pp.*], 1941.—This circular describes in detail the 6 standard tests used at the Nat. Bur. Stds in the testing of watches and chronometers. These tests consist in 4 tests for pocket watches; a test for stop watches of various grades; and a test for ship chronometers. Information is given regarding the use and care of a watch, watch sizes, watch jewels, watch-testing machines, standard time zones and time signals. Directions and general information for the submittal of timepieces for test are also given.

PHYSICS

GENERAL PRINCIPLES

376 530.19

An approximate solution for the distribution of temperature or potential with cylindrical isothermal or equipotential surfaces. WHITEHEAD, S. *Proc. Phys. Soc., Lond.*, 54, *pp.* 63–65, *Jan.*, 1942.—Dipoles or source-sink combinations are used to give an approx. solution of Laplace's equation when the boundary surfaces comprise equipotential or isothermal cylinders. The method is shown to be convenient for a symmetrical arrangement but liable to become laborious in other circumstances.

MECHANICS

377 531.55 = 3

New method for calculating the trajectory of projectiles. MOLITZ, H. *VDI* [*Z. Ver. dtsch. Ing.*], 85, *pp.* 427–428, *May* 3, 1941.—This is a brief abstract of a pamphlet by K. Stange describing an approx. method, consisting in extrapolating by means of a parabola the horizontal and vertical acceleration values, computed step by step from the values of speed and height at the start. By integrating the last step a new average value is found for the acceleration of the next step. The second approximation is obtained by a similar interpolation process. The accuracy of the method is highly satisfactory and the time required for calculation is about $\frac{1}{2}$ that used with older methods of similar accuracy. R. N.

378 531.66

The computation of wheel impact forces. COX, H. L., AUGHTIE, F., AND BROWN, A. F. C. *J. Instn Auto. Engrs*, 10, *pp.* 45–74, *Dec.*, 1941.—Wheel-impact force, or excess vertical force, due to impact,

above the mean statical value, is dealt with theoretically for the case of a self-propelled vehicle traversing a rough road. The general method of solution is illustrated by the example of a single wheel of known mass, tyre stiffness and damping factor, rolling over an obstacle in the form of an isosceles triangle. Two impacts are distinguished and measured. The dynamic characteristics of the experimental 6-wheeled vehicle employed were determined, and the oscillations of the rear part were in 6 natural modes. A series of curves gives a comparison of the experimental and calculated variations of load with time for different speeds. It is concluded at this stage that the effect of all vehicles must be very much the same, the differences being in degree and not in type. G. E. A.

379 531.7.081

Dimensions of physical quantities. WILSON, W. *Phil. Mag.*, 33, *pp.* 26–33, *Jan.*, 1942.

380 531.756.4

Maximum difference between densities of ordinary and heavy water. CHANG TSING-LIEN AND CHIEN JEN-YUAN. *J. Amer. Chem. Soc.*, 63, *pp.* 1709–1711, *June*, 1941.—The density of heavy water is measured with a quartz pycnometer between its freezing point and 50°. The differences between the densities of ordinary and heavy water show a max. at 40°.

381 531.787

Vapour pressures of binary liquid mixtures. LACHER, J. R., AND HUNT, R. E. *J. Amer. Chem. Soc.*, 63, *pp.* 1752–1756, *June*, 1941.—An apparatus is described for vapour-liquid equilibrium measurements and the conditions under which it gives accurate results have been ascertained.

LIQUIDS

See Abstr. 593 532 : 541.182.4

See Abstr. 598 532.1 : 541.182.63

382 532.13

Viscosity/temperature function of liquids. NISSAN, A. H. *Phil. Mag.*, 32, *pp.* 441–456, *Dec.*, 1941.—Over 100 liquids composed of organic and inorganic compounds and elements have been tested, and found to be governed by one viscosity/temperature law, whether associated or unassociated, complex or simple. The only pure liquid which is definitely an exception is liquid He, the viscosity of which rises with temperature. It appears that a general equation exists, giving the change of viscosity of fluids with temperature, independently of the state of the fluid. H. H. HO.

383 532.13 = 3

Influence of structure on viscosity of liquids. LINKE, R. *Z. phys. Chem. A*, 188, *pp.* 11–16, *Jan.*, 1941.—Using viscosity values of hydrocarbons, especially isomers of octane, published by previous investigators, the author discusses the influence of structure on the constants in the Andrade–Sheppard equation. R. N.

384 532.13 = 3

Viscosity of binary mixtures of liquids. LINKE, R. *Z. phys. Chem. A*, 188, *pp.* 17–26, *Jan.*, 1941.—The viscosity was measured of the 6 possible binary mixtures of benzene, toluene, chlorobenzene and cyclohexane, and the results represented by the Andrade–Sheppard equation. The logs of the viscosities of binary mixtures of benzene, toluene and chlorobenzene—but not cyclohexane—are linear functions of the logs of the viscosities of the pure substances. R. N.

385 532.13 = 3

On viscosity of binary liquid mixtures and of associated liquids. LINKE, R. *Z. phys. Chem. A*, 188, *pp.* 191–197, *April*, 1941.—The constants of the Andrade–Sheppard equation are determined from measurements of the viscosities of the systems acetone–chloroform, benzene–CCl_4, and nitrobenzene. A relation exists between the viscosity and the structure diagram of the mixtures. The changes of the intramolecular field with concentration and temperature can be studied by investigating the viscosity/temperature function of pure liquids and liquid mixtures. The existence of associations may thus be determined. [See Abstr. 384 (1942)]. R. N.

386 532.13 : 541.182.6 = 3

Viscosity as a function of concentration. IV. BREDÉE, H. L., AND BOOYS, J. DE. *Kolloid Z.*, 91, *pp.* 39–46, *April*, 1940.—The curves representing the viscosity/concentration function for colloids are different for spherical and for chain particles of different lengths, and a fundamental difference is shown to exist between natural and synthetic highly polymerized substances. The formulae developed are confirmed experimentally, and are shown to be applicable to dispersions not strictly colloidal, e.g. coarsely dispersed emulsions and low-molecular aqueous and non-aqueous solutions. The results of these investigations are compared with those of Sakurada [Abstr. 1772 (1938)] and other investigators. R. N.

387 532.51

The steady flow of ground-water to a pumped well in the vicinity of a river. BOULTON, N. S. *Phil. Mag.*, 33, *pp.* 34–50, *Jan.*, 1942.—General equations for the motion of ground-water to a pumped well are derived. Numerical values for the lowering of the water-table are calculated from these equations for a particular case. A simple formula is given for the lowering of the water-table due to pumping, at large distances from the well. The extension of the cone of depression in a direction away from the river relative to the extension in the opposite direction is expressed by a simple equation, and some typical

values are stated. Other conditions remaining the same, an increase in the distance separating the well from the river increases the extension of the cone of depression in the direction away from the river, but it has no effect in extending the cone in the opposite direction beyond the river.

388 532.542

Steady flow of a viscous fluid through a leaky tube. TURTON, F. J. *Phil. Mag.*, 32, *pp.* 457–470, *Dec.*, 1941.—In steady viscous flow through non-leaky tubes the pressure gradient along the tube is constant, but with leaky walls the present mathematical investigation shows that, while the pressure gradient may approximate closely to this constancy, for certain conditions, known to exist in practice, considerable departure from a const. pressure gradient may be found. This investigation was carried out for the biological cases of flow through tubes with membranous walls, such as the fine capillaries through the walls of which nutritious fluids get from the blood to working (e.g. muscle) cells; such tubes, which can be studied in practice, have radii of 7×10^{-4} to 3×10^{-4} cm., lengths from 5×10^{-3} to 2×10^{-1} cm., viscosities from 1×10^{-2} to 6×10^{-2} poise, and differences of pressure between inside and outside of the membrane of the order of 10^4 dynes/cm.^{2}.

H. H. HO.

389 532.61

Wetting agents. BARTELL, F. E. *Industr. Engng Chem.*, 33, *pp.* 737–740, *June*, 1941.—To evaluate a given wetting agent, information should be available concerning the following: its surface-tension lowering properties when in water and in organic liquids; its interfacial-tension lowering properties when in systems of water in contact with given organic liquids (immiscible or only slightly miscible with water); its interfacial-tension lowering properties in systems of given liquids against given solids. This last type of information can be obtained through measurement of adhesion tension values, which necessitates measurement of contact angles.

390 532.61 : 536.655 = 3

On surface energy and evaporation heat. Contribution to the morphology of liquids. DUNKEN, H., KLAPPROTH, H., AND WOLF, K. L. *Kolloid Z.*, 91, *pp.* 232–243, *June*, 1940.—[See Abstr. 2260 (1941)]. It is shown that, contrary to Stephan's theorem, the ratio (molar inner lat. ht.)/(total molar surface energy) > 2, as determined by the co-ordination number and the packing of atoms or molecules in the surface of crystals or liquids. According to recent experimental data, Stephan's number is about 3 for pure substances, equally associated in vapours and liquids, and also for substances more strongly associated in the liquid state if the dissociation energy is taken into account. Those investigations apply also to the determination of the total surface energy of a crystal of given co-ordination number, the splitting-up of the lat. ht. of vaporization into single increments, and the determination of energy and of degree of association when double molecules or supermolecules are formed. R. N.

391 532.61 : 541.183.2

Adsorption at water/air and water/organic-liquid interfaces. BARTELL, F. E., AND DAVIS, J. K. *J. Phys. Chem.*, 45, *pp.* 1321–1336, *Nov.*, 1941.—The effectiveness of ethyl, *n*-propyl and *n*-butyl alcohols in lowering the boundary tension at water/air and at water/organic-liquid interfaces was determined. An equation is derived by means of which the ratios of the actual adsorptions of a given solute at various interfaces can be determined from boundary-tension measurements. The conditions under which this equation is strictly applicable are defined. By the use of this equation the adsorption of each of the following substances—butyric acid, and ethyl, *n*-propyl, *n*-butyl and isoamyl alcohols—at various water/organic-liquid interfaces has been compared with its adsorption at the water/air surface. The adsorption of each one of these 5 substances at the interface between water and a paraffin hydrocarbon was found to be approx. the same as the adsorption of that substance at the surface of its aqueous solution. The max. free surface energy available at an interface is a major factor in determining the extent of adsorption at that interface.

392 532.612.3 : 536.421 : 548.526 = 3

The capillarity of the grain boundaries of metals, its influence on the growth of grains and its importance in steel. BENEDICKS, C. *Kolloid Z.*, 91, *pp.* 217–232, *June*, 1940.—The author explains the growth of grains in the solidification of metals, distinguishing between accidental grains, formed in the freezing process, and capillary grains, formed by capillary action if the atoms are sufficiently agitated by heat. The surface tension is reduced by adsorption of horophil substances at the grain boundaries, the cohesion between neighbouring grains is thereby reduced and the "travelling" of the boundaries hindered. The adsorption is the more effective the greater the number of hard and heatproof atomic groups formed at the boundaries. Al, Mg, V and similar substances, are particularly effective in connection with N, but the quantity that can be added of these stabilizing elements is limited by their effect on the strengths of the material. R. N.

393 532.613.4

Spreading coefficients of nekal BX solutions. RAO, M. R. B., AND DOSS, K. S. G. *Proc. Indian Acad. Sci. A*, 14, *pp.* 170–177, *Aug.*, 1941.—The spreading-coefficients of paraffin oil on nekal BX (sodium dialkyl naphthalene sulphonate) solutions have been determined by the floating-lens technique of Langmuir. These measurements, combined with the

surface tension of the aqueous solutions, give an exact idea of the wetting characteristics of the solutions. A rough measure of the wetting power is shown to be given by a measurement of the surface tension of the aqueous solution. It is also shown that small quantities of nekal greatly improve the spreading-qualities of oils on polar surfaces. The spreading-coefficients of nekal BX solutions are found to be negative, even at the highest concentrations tried, and it is therefore suggested that the wetting takes place by penetration and not by spreading. Thus, the adhesion tension of the aqueous solutions against oil gives a more correct measure of the wetting power. H. H. HO.

394 532.613.5 : 533.17

Rapid formation of gas bubbles in liquids. EVERSOLE, W. G., WAGNER, G. H., AND STACKHOUSE, E. *Industr. Engng Chem.*, 33, *pp.* 1459–1462, *Nov.*, 1941.—Gas bubbles were formed in pure liquids and solutions by passing nitrogen gas through submerged orifices (radii of 0·0069 to 0·017 cm.) at rates of 0·125 to 0·7 cm./sec. Bubble size was determined from stroboscopic frequency measurements and rate of gas flow and from micrometer measurements of the photographic images. As the bubble frequency was relatively constant in all pure liquids, the bubble volume in pure liquids was found to depend principally on the rate of gas flow.

395 532.62 : 541.183

The spreading of oils on water. III. Spreading-pressures and the Gibbs adsorption relation. ZISMAN, W. A. *J. Chem. Phys.*, 9, *pp.* 789–793, *Nov.*, 1941.—[See Abstr. 46 (1942)]. The Gibbs adsorption relation between surface tension and concentration is applied to new data on the equilibrium pressure of spreading of oil drops containing long-chain alcohols. It is found that the graph of pressure against concentration is an hyperbola, and an empirical formula is fitted to the measurements for each alcohol. An equation of state is derived of the polar molecules adsorbed at the oil/water interface. It is shown that the interfacial monolayer is a stable mixed film made up of polar and non-polar molecules, the latter being components originally of the oil. It is pointed out that these conclusions may be significant in the interpretation of film phenomena such as are involved in the stabilization of emulsions and the structure of cell membranes.

396 532.63 = 3

On capillary systems. MANEGOLD, E., SOLF, K., AND ALBRECHT, E. *Kolloid Z.*, 91, *pp.* 243–275, *June*, 1940.—Extending previous investigations [Abstr. 2901 (1931), 3309 (1933)], the author develops a theory of the transition of a phase boundary surface through single capillaries and capillary systems accounting also for the time and pressure required in the formation of the bubbles on the exit side. The capillary pressure of curvature of the bubble is neglected. Tables are given of the time and pressure values for various sizes of the capillary and for phase couples of different surface tension and viscosity. A capillary composed of a wider and a narrower part is also considered. The results of the investigations are compared with those of Knöll [Abstr. 2565 (1940)]. R. N.

397 532.68 : 553.982

Production engineering. SCOTT, G. H. *Ann. Rev. Petrol. Technol.*, 6, *pp.* 54–68, 1941.—The paper reviews recent literature on oil-field production and covers such matters as well-spacing, nature of the reservoir-rock, well-control, etc. W. A. R.

See Abstr. 589 532.71 : 541.182

398 532.712 = 3

On the conceptions regarding the origin of osmotic pressure. THIEL, A. *Kolloid Z.*, 91, *pp.* 316–318, *June*, 1940.—The author refutes objections raised by Metcalf [Abstr. 2564 (1940)] against his theory of osmotic pressure [Abstr. 1926, 4830 (1937), 2315 (1940)]. R. N.

See Abstr. 465 532.712 : 536.653

399 532.72

Thermal diffusion of binary salt solutions. A note on the paper of Gillespie and Breck. HIROTA, K. *Bull. Chem. Soc. Japan*, 16, *pp.* 232–234, *July*, 1941.—[See Abstr. 1130 (1941)].

See Abstr. 597 532.72 : 541.182.6

400 532.73 : 518.3

Nomographs for the solubilities of hydrogen and nitrogen in liquid ammonia. DAVIS, D. S. *Industr. Engng Chem.*, 33, *pp.* 1454–1455, *Nov.*, 1941.

401 532.733

The solubility diagram for the system vinyl-acetate/acetic-acid/water. SMITH, J. C. *J. Phys. Chem.*, 45, *pp.* 1301–1303, *Nov.*, 1941.

402 532.77 : 536.423.1 : 535.327

Boiling-point elevation of sucrose solutions. TRESSLER, C. J., ZIMMERMAN, W. I., AND WILLITS, C. O. *J. Phys. Chem.*, 45, *pp.* 1242–1245, *Nov.*, 1941.—Values obtained for the b.p. elevation of sucrose solutions vary considerably according to the method used. The values presented are somewhat lower than those of other investigators, the b.p. elevation for standard syrup being 3·80 deg. C. or 6·84 deg. F. In the actual preparation of maple syrup deviations from this standard value may be expected, owing to the fact that the thermometer is customarily read while it is dipping into the superheated boiling solution, and to the presence of certain amounts of invert sugar and substances other than sugar.

See Abstr. 627, 628 532.77 : 541.8

GASES

See Abstr. 459 533.15 : 536.46

403 533.15 : 539.217.5

Further study of the flow of air through porous media. SULLIVAN, R. R. *J. Appl. Phys.*, 12, *pp.* 503–

508, *June*, 1941.—The streamline flow of air through highly porous wads of textile fibres is studied. The rate of flow is found to be twice as great for fibres parallel to flow as for fibres perpendicular to flow. Shape factors for the channels through which the flow takes place are determined and compared with those for the ideal case of Emersleben. The problem of measuring specific surface of high-porosity wads is discussed.

See Abstr. 394 533.17 : 532.613.5

SOUND. VIBRATIONS

404 534.12 : 629.13 = 3

Bending oscillations of airscrew blades. MAIER, E. *Ingen.-Arch.*, 11, *pp.* 73–98, 1940, *Abstr. in VDI* [*Z. Ver. dtsch. Ing*], 85, *pp.* 390–391, *April* 19, 1941.—The problem of determining the characteristic frequencies of a rotating bar twisted around its axis according to an optional law leads to 2 simultaneous differential equations of the 4th order. Approximation methods due to Ritz and Grammel are used for a step-by-step solution. A formula is derived for calculating the characteristic frequencies of the rotating blade and the errors due to neglecting the twist and the divergence of the field of centrifugal force are discussed.

R. N.

405 534.13

The initial transients of organ pipes. NOLLE, A. W., AND BONER, C. P. *J. Acoust. Soc. Amer.*, 13, *pp.* 149–155, *Oct.*, 1941.—A variety of pipes is studied by means of oscillograms to find the wave form in the transient state, the time from the entry of wind to the appearance of the fundamental and to the beginning of the steady state, and other data. These are tabulated for 28 pipes belonging to the different tone families. Some of Trendelenburg's results are confirmed [Abstr. 796 (1937)]. The beginning of sound in flute stops is slow and uncertain, and the 3rd partial is often prominent, whereas the 2nd partial is present in diapason pipes. Definite evidence confirmed the fact that inharmonic partials may be present during the transient state. G. E. A.

406 534.213

The influence of diffusion on the propagation of shock waves. COWLING, T. G. *Phil. Mag.*, 33, *pp.* 61–67, *Jan.*, 1942.—It is shown that in the propagation of shock waves through a gas-mixture diffusion produces effects similar to those of viscosity and thermal conduction. If the mol. wts. of the two gases are not very different, the effects are small: when they are as widely different as those of hydrogen and oxygen, the diffusion effects are more important than those of thermal conduction and are comparable with those of viscosity. The velocities of diffusion involved are an appreciable fraction of the velocity of sound in the gas.

407 534.213 : 550.341 = 956

Studies on the propagation of an artificial earthquake wave through superficial soil or sand layers, and the elasticity of soil and sand. III. NASU, N. *Bull. Earthq. Res. Inst., Tokyo*, 18, *pp.* 289–304, *June*, 1940.—The travel-time curves of a seismic wave propagated through various sediments are discussed. The curves are expressed by equations of the form $\triangle = at + bt^2$. The depths of penetration Z_B of the ray may be computed by the expression

$$Z_B = \frac{a^2}{8\pi b}(\sinh q - q).$$

408 534.321.9 : 541.64 = 3

On the kinetics of supersonic depolymerization. SCHMID, G. *Z. phys. Chem. A*, 186, *pp.* 113–128, *May*, 1940.—Assuming the velocity of depolymerization $\propto$ (Loschmidt's number) $\times$ (difference between average degree of polymerization and its final value) a formula is derived which agrees with experimental results. The investigations confirm previous results [*Abstr.* 2679 (1940)]. R. N.

409 534.37

Investigation of the resistance of frictional layers for sound-absorbing systems. RSCHEVKIN, S. N., AND TEROSSIPJANTZ, S. T. *J. Phys., U.S.S.R.*, 4, 1–2, *pp.* 45–56, 1941.—Theoretical formulae are derived for calculating the mechanical impedance of finely perforated screens. The resistance of such frictional layers when the dia. of the holes is less than 0·03 cm. is practically independent of the frequency. The calculations have been applied to metallic wire nettings, and a description is given of an experimental arrangement for measuring the acoustic impedance by the method of standing waves in a tube, without using standards of resistance or reactance. The resistances of frictional layers of different densities were measured for the frequency range 100 to 2 500 c./s., and values of the resistance per cm.^{2} varied from 0·1 to 80 mech. ohm/cm.^{2} The results for nettings and perforated foil are in good agreement with the theoretical calculations. G. E. A.

410 534.37

Sound absorption in dielectrics. POMERANCHUK, I. J. *J. Phys., U.S.S.R.*, 4, 6, *pp.* 529–536, 1941.—A mathematical theory, apparently in extension of an investigation by Akhieser on similar lines. An ideal infinite single crystal forms the dielectric, and in the analysis it is brought out that sound absorption is determined by the anharmonic terms of the solution only if a specified condition is satisfied. When this condition does not hold, the absorption is mainly caused by collisions of 4 "phonons." The dependence of the absorption on temperature is not the same as given by Akhieser. G. E. A.

411 534.37

Heat-conduction damping of pulsating gas bubble in liquid which resonates to supersonic wave. SANE-

YOSI, Z. *Electrotechn. J.*, 5, *pp.* 49–51, *March*, 1941.—A gas bubble in a sound field resonates by expansion and contraction at the frequency for which the elastic reactance of the gas balances the radiation impedance. This frequency was calculated by Smith [Abstr. 3588 (1935)] and confirmed experimentally by Meyer. Smith also calculated the damping due to sound re-radiation, but Meyer's measured values of the damping are far greater than those calculated. The author has worked out the damping effect due to heat conduction in the bubble and finds that the damping due to heat conduction is much greater than that due to sound re-radiation and his result approaches the value found by Meyer. G. E. A.

412 534.7 : 621.385.8

Electronics in auditory research. SPEAKER, D. M. *Electronics*, 14, *pp.* 38–41 *and* 92–93, *Sept.*, 1941.—A description is given of a 6-stage amplification system used for observing the "action potential," or electrical output from the auditory nerve, when the ear has sounds of various frequencies transmitted to it. The experiments are carried out on animals under ether anaesthesia. Owing to the fact that the voltages to be observed are extremely low, of the order of 3 to 10 μV, special care has to be taken in the selection of valves and circuit components in order to obtain a high gain with comparative freedom from background noise. An account is also given of the equipment used for measurements on human hearing, including frequency response, threshold levels, etc. The various types of deafness are described in some detail and discussed, and an outline is given of the use of the various measurements both in diagnosis and in determining the progressive effect of treatment. The paper concludes with a description of apparatus used for testing speech reception: standard sentences are spoken into a microphone and sent to the subject at various levels. The level at which the sentence is no longer intelligible gives a measure of the quality of the subject's hearing. A. W.

413 534.8 : 623.55 = 3

Acoustical location for shooting at invisible aircraft. KUHLENKAMP, A. *VDI* [*Z. Ver. dtsch. Ing.*], 85, *pp.* 393–400, *April* 26, 1941.—Reasons for the inferiority of sound locating to optical methods are given. The principles of sound locating are discussed and a mechanism for computing the delay is described. The principle of the cotangent method is explained. Equipments developed in France and Austria are described and illustrated. R. N.

414 534.8 : 669.71 = 3

On degasification of light metal alloys by sonic oscillations. ESMARCH, W., RUMMEL, T., AND BEUTHER, K. *Wiss. Veröff. Siemens Werke Werkst.-Sonderh.*, *pp.* 78–87, 1940. *Abstr. in VDI* [*Z. Ver. dtsch. Ing.*], 85, *p.* 548, *June* 14, 1941.—Gases absorbed by Al and its alloys considerably impair their strength and ductility. By subjecting the material to sonic oscillations during the solidification process the absorption of gases is effectively reduced. The sonic waves are generated in the molten material by electrodynamic forces; the crucibles containing 10 kg. of the alloys are placed inside a coil fed by d.c. and a.c. of 10 000 c./s., and the interaction between the static magnetic field produced by the d.c. and the h.f. currents generated inductively in the bath causes mechanical oscillations which may be amplified by resonance. Degasification was obtained in less than $\frac{1}{2}$ hr. R. N.

415 534.812 : 621.396.625.9

The stereophonic sound film system—general theory. FLETCHER, H. *J. Acoust. Soc. Amer.*, 13, *pp.* 89–99, *Oct.*, 1941.—A stereophonic transmission system consisting of 3 complete channels working together could pick up symphonic music, etc., in Philadelphia, transmit it to a hall in Washington and reproduce it there without distortion or noise [Abstr. 733 B (1934)]. Each channel comprises a microphone, amplifier, predistorting and corrective network, transmission line, amplifier, restoring and corrective network, variable distorting network and attenuator, power amplifier and loud-speaker. Part of the foregoing is contained in a control box by means of which the director of the orchestra could increase or decrease the level of the bass, give signals to the orchestra, govern the tempo and give instructions to the leader. In the development of the present system (SSFS) nearly all the features of the transmission system were retained. The fundamental requirements on which the transmission and recorder-reproducer systems are based are the same, and these are reviewed in the present paper. G. E. A.

LIGHT

416 535.215.3

The photovoltaic effect. FINK, C. G., AND ADLER, E. *Trans. Electrochem. Soc.*, 79, *pp.* 367–374; *Disc.*, 375, 1941.—[Abstr. 320 B (1942)].

417 535.215.4 : 537.312.5 : 621.383.8 : 621.314.63

Semi-conductor photocells and rectifiers. FINK, C. G., AND ADLER, E. *Trans. Electrochem. Soc.*, 79, *pp.* 377–412; *Disc.*, 412, 1941.—[Abstr. 321 B (1942)].

418 535.24

An automatic recorder of spectral sensitivity of photo-electric surfaces. TYKOCINER, J. T., AND BLOOM, L. R. *J. Opt. Soc. Amer.*, 31, *pp.* 689–692, *Nov.*, 1941.—A method of recording automatically spectral sensitivity of photo-electric surfaces has been developed. It consists of a Hardy spectrophotometer supplied with attachments for 60 c./s. modulation of 2 glow discharge lamps. One of the lamps, serving as light-intensity reference source, is supplied with an iris whose aperture is controlled mechanically

by the analyser can. The other lamp is controlled photo-electrically so that its light-intensity is ∝ the rel. spectral sensitivity of the investigated photo-electrical surface. Light emitted by both lamps is received by the detector photo-tube which by means of thyratrons controls the recording mechanism.

419 535.24

A physical photometer. TEELE, R. P. *Bur. Stand. J. Res., Wash.*, 27, *pp.* 217–228, *Sept.*, 1941. *J. Opt. Soc. Amer.*, 31, *pp.* 696–704, *Nov.*, 1941.—A physical photometer which "sees" light in accordance with the ICI luminosity factors has been constructed. This photometer gives results which are consistent with the ICI luminosity factors and which are more accurate than those of visual observers when the light transmissions of coloured filters are measured.

420 535.24 : 628.9

Illuminating-engineering nomenclature and photometric standards. *Illum. Engng, N.Y.*, 36, *pp.* 813–852, *Sept.*, 1941.—[Abstr. 359 B (1942)].

421 535.241.3 : 522.5

Recalibration of standard lamps of the Dominion Astrophysical Observatory. MCKELLAR, A., AND PETRIE, R. M. *J. Roy. Astr. Soc. Can.*, 35, *pp.* 337–342, *Oct.*, 1941.—Four ribbon-filament tungsten lamps were obtained 15 years ago from the Nela Park Laboratories and the calibration of colour temperature in terms of current was determined there by Forsythe. These lamps, of which 3 have been little used, have recently been recalibrated by comparison with a quartz standard lamp calibrated at Delft, Holland. The comparison was done photographically. No systematic difference between the two calibrations was found and the general agreement was considered to be satisfactory. J. W. T. W.

422 535.247

A laboratory experiment on luminous intensity. GLADDEN, S. C. *Amer. J. Phys.*, 9, *pp.* 283–284, *Oct.*, 1941.—Describes a simple laboratory layout for the demonstration of the luminous intensity of a lamp in a horizontal plane. A rotatable lampholder is mounted at a given distance from a metal photocell photometer, and the luminous intensity is read for all angular positions and plotted against volts and watts. Typical curves of results are given.

E. H. W. B.

See Abstr. 486, 487 535.3 : 537.531

423 535.32 = 3

Refractive indices of media with bound and free electrons. MANDELSTAM, L. I. *J. Phys., U.S.S.R.*, 4, 1–2, *pp.* 9–11, 1941.—From consideration of the properties of a model medium containing protons and electrons, an illustration is given of the difference between media with bound electrons and media with free electrons. In the former case it is shown that the Lorentz–Lorenz formula is applicable, while in the latter case Sellmeier's formula $\mu^2 - 1 = \beta N$ should be used. A. W.

424 535.321

The Brewsterian angle and refractive indices. PFUND, A. H. *J. Opt. Soc. Amer.*, 31, *pp.* 679–682, *Nov.*, 1941.—On the basis of Brewsterian-angle measurements, a procedure is outlined which yields refractive indices with uncertainties in the third decimal place. Since bulk refractive indices are desired, it is shown that the errors due to surface films may be eliminated by making measurements only on freshly ground and polished surfaces. Attention is directed to applicability of this procedure when the refractive indices of black materials are to be determined.

425 535.322.4

A new precision refractometer. HUGHES, J. V. *J. Sci. Instrum.*, 18, *pp.* 234–237, *Dec.*, 1941.—A refractometer capable of giving refractive indices and dispersions to 1 unit in the fifth decimal place is described. The samples are smooth ground, but not polished, and require little care in preparation; the sample has 2 faces ground to a rt. angle and is sealed between two 45°–45°–90° prisms by a liquid of reasonably close refractive index. The deviation produced by the combination is measured with a telescope and scale. A complete determination (Na D, C and F lines) can be made in 1–2 hr.

426 535.325

Refractive indexes of gases at high radio frequencies. KERR, F. J. *Nature, Lond.*, 148, *pp.* 751–752, *Dec.* 20, 1941.

See Abstr. 402 535.327 : 536.423.1 : 532.77

427 535.33

Spectrographic analysis of briquetted tablets. DIETERT, H. W. *J. Opt. Soc. Amer.*, 31, *pp.* 693–696, *Nov.*, 1941.

428 535.33.07

The purification of spectrographic carbons. ZIETLOW, R., HAMM, P., AND NELSON, R. C. *Science*, 94, *p.* 438, *Nov.* 7, 1941.

429 535.338

The influence of restricted rotation on the absorption spectra of aryl-substituted aromatic hydrocarbons. JONES, R. N. *J. Amer. Chem. Soc.*, 63, *pp.* 1658–1661, *June*, 1941.

430 535.338

Raman spectra of acetylenes. V. Alkyl acetylenes. MURRAY, M. J., AND CLEVELAND, F. F. *J. Amer. Chem. Soc.*, 63, *pp.* 1718–1721, *June*, 1941.—[See Abstr. 1587 (1941)].

431 535.338

Improved computations on conjugation and hyperconjugation. MULLIKEN, R. S., AND RIEKE, C. A. *J. Amer. Chem. Soc.*, 63, *pp.* 1770–1771, *June*, 1941.

432 535.338

Isotope effect in the (OH), (OD) bands. SASTRY, M. G. *Curr. Sci.*, 10, *pp.* 362–363, *Aug.*, 1941.

433 535.338

Possible Earth's field effect on atmospheric oxygen spectrum intensities. ARLICK, A. A. *Sci. and Cult.*, 7, *pp.* 170–171, *Sept.*, 1941.

434 535.338

The spark spectrum of europium, Eu II. RUSSELL, H. N., ALBERTSON, W., AND DAVIS, D. N. *Phys. Rev.*, 60, *pp.* 641–656, *Nov.* 1, 1941.—The number of levels identified is 156; of lines classified, 467. All the stronger lines are included. About 2 000 lines remain unclassified. They probably arise from transitions between levels based upon higher limits in the f^7 configuration of Eu III. Series of 3 consecutive $^9S°$ and $^7S°$ terms give the value 11·21 V for the ionization potential. Zeeman effect: Patterns for 459 lines, measured with a field of 87 850 gauss, are tabulated. The g values for 118 levels have been determined. Those for the low levels agree with theory; the higher levels are much perturbed. Patterns for a few lines of Eu I and Eu III are given. The latter confirm that the ground state is $^8S°$.

435 535.338

Infra-red and Raman spectra of polyatomic molecules. XV. Diborane. STITT, F. *J. Chem. Phys.*, 9, *pp.* 780–785, *Nov.*, 1941.—[See Abstr. 783 (1940)]. The infra-red spectrum of diborane was studied on a prism spectrometer from 400 to 4000 cm.$^{-1}$ Absorption occurs over much of the region investigated. A reliable and complete analysis of the infra-red and Raman spectra of diborane must await further work, but 2 alternative tentative analyses of the main features are presented which are in accord with the heat capacity of gaseous diborane from 100° to 300°K. One of these analyses is based on the assumed existence of a singlet electronic state at 412 cm.$^{-1}$ above the ground state and requires the potential barrier to internal rotation within the molecule to be of the order of 15 000 cal./mole. The alternative analysis assumes that no electronic state lies less than 1 600 cm.$^{-1}$ above the ground state and requires a potential barrier of about 5 000 cal./mole. Both analyses assume an ethane-like structure for the diborane molecule.

436 535.338

On the $^2\Pi_u \rightarrow {}^2\Pi_g$ bands of CO_2^+. I. MROZOWSKI, S. *Phys. Rev.*, 60, *pp.* 730–738, *Nov.* 15, 1941.—The band spectrum appearing in emission in the region λ2 900–4 300 and believed to belong to the CO_2^+ or possibly CO_2 molecule was studied and the excitation conditions found to be in substantial agreement with the former results. The bands were obtained with great intensity and photographs of most of them made in the second order of the 30 ft. grating. The rotational structure and the excitation conditions show that most of the bands belong to an extensive $^2\Pi \rightarrow {}^2\Pi$ system of bands of the molecule CO_2^+.

437 535.338

Analysis of the near ultra-violet absorption spectrum of monochlorobenzene. SPONER, H., AND WOLLMAN, S. H. *J. Chem. Phys.*, 9, *pp.* 816–825, *Nov.*, 1941.—The absorption spectrum of C_6H_5Cl at 2 750–2 400 Å was studied in the first order of a 3 m. grating spectrograph. The band system corresponds to an electronic transition $A_1 \rightarrow B_1$ (monochlorobenzene has the symmetry C_{2v}) with the transition moment lying in the molecular plane perpendicular to the C–Cl bond. In agreement with this assignment to an allowed transition the 0,0 band appears strongly. Several progressions have been found, involving various totally symmetrical vibrations. Besides this allowed part of the spectrum there appear forbidden bands which are due to the excitation of a non-totally symmetrical vibration of suitable symmetry. This vibration corresponds to the one (ε_g^+ 606 cm.$^{-1}$) whose excitation is responsible for the appearance of the benzene spectrum. The analysis is supported by comparison with the absorption of solid monochlorobenzene at − 259°C.

438 535.338

Quenching and depolarization of mercury resonance radiation by the rare gases. OLSEN, L. O. *Phys. Rev.*, 60, *pp.* 739–742, *Nov.* 15, 1941.—The quenching and depolarization of Hg 2 537 Å resonance radiation by He, Ne, A and Kr, was studied experimentally, the results being displayed in graphical and tabular form. Probable numbers of quenching and depolarizing collisions and cross-sections for quenching and depolarization are calculated and presented in a table. [See Abstr. 1967 (1941)].

439 535.338 : 539.13

Band spectrum and structure of the BCl molecule. HERZBERG, G., AND HUSHLEY, W. *Canad. J. Res. A*, 19, *pp.* 127–137, *Nov.*, 1941.—The $^1\Pi$–$^1\Sigma^+$ system of the BCl molecule has been photographed in the sixth order of a 20 ft. grating. The previous interpretation of the vibrational structure by Miescher is slightly modified. The new formula for the Q heads of the $B^{11}Cl^{35}$ molecule is

$$\nu = 36750{\cdot}92 + 849{\cdot}04(v' + \tfrac{1}{2}) - 11{\cdot}37(v' + \tfrac{1}{2})^2 - 0{\cdot}100(v' + \tfrac{1}{2})^3 - 0{\cdot}0271(v' + \tfrac{1}{2})^4 - [839{\cdot}12(v'' + \tfrac{1}{2}) - 5{\cdot}11(v'' + \tfrac{1}{2})^2]$$

The fine structure of a number of bands has been measured and analysed, leading to the following accurate values for the rotational constants: $B_e' = 0{\cdot}7054$ cm.$^{-1}$, $\alpha_e' = 0{\cdot}00820$ cm.$^{-1}$, $B_e'' = 0{\cdot}6838$ cm.$^{-1}$, $\alpha_e'' = 0{\cdot}00646$ cm.$^{-1}$. The internuclear distance in the ground state is $r_e'' = 1{\cdot}716 \times 10^{-8}$ cm. The molecular constants of BCl are compared with those of the iso-electronic molecules CS, PN, and SiO as well as with those of BBr, BCl_3 and BBr_3.

See Abstr. 503 535.338 : 538.615

See Abstr. 476 535.338:541.634:539.133:537.226.2

440 535.342 = 3

On light absorption of solutions of cobalt rhodanide solutions. KISS, Á. VON, AND CSOKÁN, P. *Z. phys. Chem. A*, 188, *pp.* 27–40, *Jan.*, 1941.—Absorption curves were determined for solutions of $Co(SCN)_2$ in mixtures of water and non-electrolytes of different concentrations, and in several organic solvents, at room temperature and for wavelengths between 200 and 700 mμ. The formation of different complexes between the solute and the molecules of the solvents is responsible for the dependence of the extinction curve on the nature of the solvent. With regard to light absorption, the co-ordinative linkage electrons are as important as the outer and the main linkage electrons. [See Abstr. 2101 (1941), 279 (1942)]. R. N.

441 535.342 = 3

Light absorption and structure of the derivatives of chlorophyll. III. Absorption of dioxy-substances. PRUCKNER, F. *Z. phys. Chem. A*, 188, *pp.* 41–59, *Jan.*, 1941.—[See Abstr. 2334 (1941)]. Investigations on the spectra of dioxy-substances formed from various porphyrines show that they are intermediate products between porphyrines and chlorines but nearer related to the latter. This is also proved by the spectra of Cu complex salts and of solutions in HCl. The co-ordination of the bands of chlorine and porphyrine and the blue and red shift of the spectra are discussed. R. N.

442 535.343.2

The absorption spectrum as a quantitative test for mercury vapour in air. CLARK, K. C., AND OLDENBERG, O. *J. Chem. Phys.*, 9, *pp.* 786–788, *Nov.*, 1941.—In order to test the mercury vapour content of the air in a laboratory, the absorption spectrum of this vapour is compared with a set of calibration spectra. With a simple apparatus v.p. far below the toxic limit can be determined.

443 535.343.3

An experimental study of the ultra-violet absorption spectrum of pyrimidine. UBER, F. M. *J. Chem. Phys.*, 9, *pp.* 777–779, *Nov.*, 1941.—The wave numbers of 112 absorption bands of pyrimidine vapour in the 2 700–3 300 Å region were determined. The bands are classified qualitatively into 4 categories as to their intensity. Assignments of individual bands into a number of series are made and all prominent series were found to have spacings of approx. 1 014 $cm.^{-1}$

444 535.371

The quenching of fluorescence in solution. III. The nature of the quenching process. ROLLEFSON, G. K., AND STOUGHTON, R. W. *J. Amer. Chem. Soc.*, 63, *pp.* 1517–1520, *June*, 1941.—It is shown, by measurements of the activity of a fluorescent substance in the presence of a quencher, that the quenching action cannot be attributed to complex formation before photo-activation. The effect of temperature and viscosity changes on the quenching process furnishes additional support. The electron transfer theory is discussed, and it is pointed out that it does not aid in the prediction of the type of quencher or quenching efficiency to be expected in any given case. [See Abstr. 3137 (1940)].

445 535.371 : 541.144.7

The fluorescence of chlorophyll and photosynthesis. FRANCK, J., FRENCH, C. S., AND PUCK, T. T. *J. Phys. Chem.*, 45, *pp.* 1268–1300, *Nov.*, 1941.—The fluorescence anomalies of the chlorophyll in leaves and algae during the induction period of photosynthesis have been observed under various conditions of temperature, light intensity and gas concentration, etc. Curves showing the fluoresence intensity as a function of time of irradiation are measured and recorded photographically by means of a photocell amplifier system. The intensity of the steady-state fluorescence which is attained after an irradiation of several minutes was measured as a function of the intensity of the exciting light. Above a certain min. intensity the fluorescence yield increases with the strength of the exciting illumination. The curve obtained fits the calculations made by Franck and Herzfeld. The effect of photosynthetic inhibitors on the steady-state fluorescence was studied. A theory is presented which explains the induction period of photosynthesis and the related fluorescence anomalies.

446 535.375 : 523.51

The luminescence of meteorites. BUDDHUE, J. D. *Amer. J. Sci.*, 239, *pp.* 839–844, *Nov.*, 1941.—A number of stone meteorites are found to be luminescent in an electrical discharge in a vacuum, but not in ultra-violet or X-rays. Olivine contributes little or nothing to the luminescence, enstatite being the most active mineral. However, not all enstatite is active. The usual colour of the glow is bluish, but 2 howardites give a yellow glow and 2 other stones contain particles giving a red luminescence. Roasting in air changed the glow of one stone to green. This phenomenon may be of value in distinguishing separate falls of similar meteorites in nearby localities. It may also have some bearing on the violet type, continuous spectra of comets.

447 535.42

A new formula for the reduction of Lummer-plate fringes. BEHRENS, D. J. *J. Sci. Instrum.*, 18, *pp.* 238–239, *Dec.*, 1941.—A simple formula is derived for the reduction of measurements made with a Lummer plate. It is valid up to the centre of the fringe system, so that the region of best resolving power and dispersion can be used without the introduction of the errors inherent in McNair's approximation. These can in certain cases be as great as

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10%, whilst the errors in the new formula do not exceed 0·01 of this amount.

448 535.435

Relaxation in liquids and scattering of light. LEONTOVICH, M. *J. Phys., U.S.S.R.*, 4, 6, *pp.* 499–514, 1941.—The relaxation theory of the viscosity of liquids is applied to the question of the structure of the Rayleigh line in the scattered light. For this purpose the fundamental equations of the theory are discussed, as well as types of disturbances in liquids with relaxation and scattering of light. The intensity distribution in the spectrum of the Rayleigh line and of its background, and the distribution of the polarization, is determined. Also, the connection between the double refraction due to the flow of liquid, the relaxation time and the depolarization of the scattered light, is indicated. An appendix contains the calculation of the mean squares of the Fourier coefficients for accidental processes. H. H. HO.

See Abstr. 634, 635 535.5 : 548

449 535.62

Problems of colour mixing in the dyeing industry. GRUNDY, J. G. *Proc. Phys. Soc., Lond.*, 54, *pp.* 1–7; *Disc.*, 7–13, *Jan.*, 1942.

450 535.762

Some effects of binocular vision. ALLEN, F. H. *Science*, 94, *pp.* 486–487, *Nov.* 21, 1941.

HEAT

451 536.21

A method of measuring the thermal conductivity of rock cores. HERSEY, J. B. *J. Appl. Phys.*, 12, *pp.* 498–501, *June*, 1941.—A method of measuring the thermal conductivity of long rock core samples is described. It is an adaptation of Bidwell's method of measuring the thermal conductivity of metals. The core is packed in silocel in a cylindrical container. Heat is supplied by a flat electric heater on one end of the core sample, and measurements of temperature are made along the core and at several radial distances in the insulator. Isothermal surfaces in the insulator are determined and found to be conical surfaces within several cm. of the core. These are parallel for some distance along the core. Using this fact, the conductivity of the core is computed relative to that of the silocel. A value $5{\cdot}92 \times 10^{-3}$ cal./cm. deg. sec. was obtained for a sample of norite and $2{\cdot}59 \times 10^{-3}$ for a pyrex rod at room temperature.

452 536.24

A practical system of units for the description of the heat exchange of man with his environment. GAGGE, A. P., BURTON, A. C., AND BAZETT, H. C. *Science*, 94, *pp.* 428–430, *Nov.* 7, 1941.—The practical units suggested are: a thermal activity unit, the *met*, defined as 50 cal./hr.m.^{2} of the surface area of the individual (or 18·5 B.Th.U./ hr.ft.^{2}), which is approx. the metabolism of a man sitting under conditions of thermal comfort; and a unit expressing the thermal insulation of clothing, the *clo*, which has a value of 0·18 deg. C./cal. hr.m.^{2} (or 0·88 deg. F./B.Th.U. hr.ft.^{2}) which represents the amount of insulation required to maintain a sitting man in comfort in a normally ventilated room having air at 70°F. and less than 50% rel. humidity moving at 20 ft./min. Tables are given, expressing (1) the insulation value of ambient air in *clo* units for various conditions, (2) optimal temperatures for comfort with exercise (1 to 4 *mets*) in normal clothing and (3) ideal clothing (*clo* values) for comfort with various temperatures and amounts of activity. R. W. P.

453 536.242 : 541.127

Agitation. Heat and mass transfer coefficients in liquid/solid systems. HIXSON, A. W., AND BAUM, S. J. *Industr. Engng Chem.*, 33, *pp.* 1433–1439, *Nov.*, 1941.—An equation is derived, expressing the rate of melting of the solid in a two-phase, single-component, liquid/solid system, based on the rate of heat transfer at the liquid/solid interface. This equation resembles the approx. integrated form of the cube-root law, and the surface coefficient of heat transfer, h, is comparable to the dissolution constant, K. The equation correlating heat transfer data for several liquids in a series of geometrically similar agitators is similar in form to the expression correlating data on mass transfer in the same equipment, and an analogy between heat and mass transfer in liquid/solid agitation systems is indicated. Applications of this analogy to studies of reaction kinetics are suggested. A method for correlating heat transfer data in jacketed and coil-heated agitation vessels is proposed and confirmed by the data on heat transfer from a platinum wire in an agitated vessel.

454 536.4

Specification for the measurement of the transmission of heat and light through heat-absorbing glasses employed for glazing purposes. *Illum. Engng, N.Y.*, 36, *pp.* 931–933, *Nov.*, 1941.

See Abstr. 392 536.421 : 548.526 : 532.612.3

455 536.421.1

The effect of viscosity on the melting rate of soda–lime–silica glasses. PRESTON, E. *J. Soc. Glass Technol.*, 25, *pp.* 221–230 (*T*), *Aug.*, 1941.—Data on the melting rate of certain soda–lime–silica glasses, as measured by the time required to become batch-free, have been examined and compared with their viscosities or with those of similar glasses. To a first approx. batch-free time is proportional to the viscosity of the glass at the melting temperature. Both melting and crystallization are dependent on diffusion processes within the glass, and viscosity is the most important factor controlling diffusion.

456 536.421.1

Depression of the m.p. of α-toxicarol and related

compounds in soft-glass capillary tubes. JONES, H. A., AND WOOD, J. W. *J. Amer. Chem. Soc.*, 63, *pp.* 1760–1761, *June*, 1941.

457 536.421.1

Freezings and compressions to 50 000 kg./cm.^{2} BRIDGMAN, P. W. *J. Chem. Phys.*, 9, *pp.* 794–797, *Nov.*, 1941.

See Abstr. 402 536.423.1 : 535.327 : 532.77

458 536.44

A demonstration of some critical phenomena. SAGE, B. H., AND REAMER, H. H. *Amer. J. Phys.*, 9, *pp.* 310–312, *Oct.*, 1941.—The critical state of a liquid-gas may be shown on a screen by the use of this apparatus, comprising a short capillary tube enclosing the test liquid, means of increasing the pressure on the liquid, means of increasing the temperature of the whole, and a pressure gauge and thermometer. The thermometer image is projected on the screen alongside that of the liquid in the capillary, so that the critical state can be watched. E. H. W. B.

459 536.46 : 533.15 = 3

Separation of isotopes and mechanism of combustion in rising flames of H_2–D_2. CLUSIUS, K., KÖLSCH, W., AND WALDMANN, L. *Z. phys. Chem. A*, 189, *pp.* 131–162, *Aug.*, 1941.—The diffusion phenomena in rising flames of mixtures H_2–O_2, D_2–O_2 and H_2–D_2–O_2, are investigated, with a view to establishing the relative part played by ordinary and thermal diffusion in the separation of isotopes. The flame points of H_2, D_2, and a 1 : 1 mixture of both, were determined; their difference cannot be explained as due to different impact numbers or heat of activation. The ratio of the concentrations of the 2 isotopes is approx. the inverse of the respective diffusion coefficients. This makes it highly probable that the flame is kept burning mainly by diffusion, which also causes the separation of the isotopes [Abstr. 2456 (1941)]. The separation factors for the gas residue and for the combustion water were determined, and from these values the relative flame vol. and the diffused part of the burning H_2 was calculated. R. N.

See Abstr. 568 536.49 : 541.127

460 536.521

Measurement of flame temperature by spectral reversal method using photography. KINOSITA, K., AND ARITA-KENZI. *Proc. Phys.-Math. Soc. Japan*, 23, *pp.* 646–663, *Aug.*, 1941.—An attempt is made to determine the reversal temperature more accurately by microphotometric analysis of photographic records, but difficulty is experienced on account of fluctuations in flame temperature. The analysis shows the D lines to be 0·5 to 1·5 Å in width with an indentation in the centre of each emission line due to self-absorption by the cooler outer edges of the flame. The nature of the record consistent with a reversal due to the hottest temperature of the flame is determined, and the photographic method is thought to be capable of high accuracy provided the flame temperature remains constant. R. W. P.

461 536.532

Further considerations relating to a proposed new type of pyrometer for measuring gas temperatures. ROWSE, R. H. *J. Sci. Instrum.*, 18, *pp.* 240–242, *Dec.*, 1941.—Further consideration is given to a proposed new type of pyrometer for measuring gas temperatures [Abstr. 1325 (1941)]. The results of a general mathematical analysis are given, together with tables giving an abbreviated list of sets of wire gauges which satisfy the problem.

462 536.58

Control point computed for cracking furnace. SUMMERS, R. E. *Engng Exp. Sta., Univ. Minnesota, Minneapolis, Techn. Pap. No.* 31, [2 *pp.*], 1941.—A formula is derived for determining the point at which the temperature of an oil-cracking still should be controlled, the accepted criterion being that the control point is that at which the cracking rate has the average value for the section concerned. R. W. P.

463 536.587 : 621.316.74

Thermostats employing external surface control. HOPPER, V. D., AND LABY, T. H. *Proc. Phys. Soc., Lond.*, 54, *pp.* 55–62, *Jan*, 1942.—The principles involved in the production of constant temperature are discussed. These principles have been applied to the design of temperature-controlling systems using an external resistance thermometer to control the heat supply, which may be radiant heat or heated air. The hunting in the system in each case is less than 1 sec. Control of the temperature of apparatus to better than 0·01°C. has been obtained.

464 536.63 : 541.66

Heat capacities of organic vapours. DOBRATZ, C. J. *Industr. Engng Chem.*, 33, *pp.* 759–762, *June*, 1941.—The method of calculating heat capacities of organic vapours from valence-bonding frequencies [Abstr. 2494 (1938)] has been modified by the assumption of rotation within the molecule so as to give more accurate results. Frequencies have been assigned to valence bondings with halogens, N and S, which, when used with those originally assigned to C, H and O bondings, enable the calculation of the heat capacities of the vapours of practically all organic compounds formed from these elements. The values of the Einstein functions at different temperatures corresponding to the assigned frequencies have been fitted to equations of the form, $C_p = A + BT + CT^2$, so as to simplify computations. An illustration shows the method of calculating heat capacities, and comparison of calculated and experimental data indicates that an accuracy within 5% can be expected in most cases.

465 536.653 : 532.712 = 3

Entropy of mixture and heat of dilution of dilute solutions of triacetyl cellulose in dioxane. KUNZE, F.

Z. phys. Chem. A, 188, *pp.* 90–98, *March*, 1941.—Osmotic pressure as a function of temperature is investigated and the entropy of mixture and differential heat of dilution are calculated. The heat of dilution is positive for conc. $< 6{\cdot}22$ g./l. and negative for higher concentrations. This phenomenon, as well as the rise of osmotic pressure with temperature, is ascribed to molecular association. R. N.

466 536.655

Latent heats of vaporization. MEISSNER, H. P. *Industr. Engng Chem.*, 33, *pp.* 1440–1443, *Nov.*, 1941.—If the critical pressure and critical temperature of a pure liquid are known, its molal lat. ht. of vaporization at any temperature can be computed from vapour-pressure data alone by the equation:

$$d \log p_0/d(1/T_0) = -\Delta H/R(\mu_g - \mu_L)$$

This expression is derived from the Clapeyron equation. A graphical solution is presented, from which values of $(\Delta H/T_0)$ can be obtained directly, given the reduced v.p. and the reduced temperature for the point in question.

See Abstr. 390 536.655 : 532.61

467 536.662

The heat of combustion of *cis*- and *trans*-decahydronaphthalene. DAVIES, G. F., AND GILBERT, E. C. *J. Amer. Chem. Soc.*, 63, *pp.* 1585–1586, *June*, 1941.

468 536.664 = 3

On hydrolysis of dichloro-ethanoic acid. KUNZE, F. *Z. phys. Chem. A*, 188, *pp.* 99–108, *March*, 1941.—The principal object was to investigate the dependence of activation heat and activity constant on temperature. The higher heat of activation is responsible for the fact that the ion of the dichloroacetate is more stable than that of the monochloroacetate. R. N.

469 536.75 : 541.123.4 : 539.133

Tables of thermodynamic functions of paramagnetic substances and harmonic oscillators. HULL, J. R., AND HULL, R. A. *J. Chem. Phys.*, 9, *pp.* 465–469, *June*, 1941.—Numerical values of the partition function, magnetic moment, entropy and temperature derivative of the entropy, are tabulated for free paramagnetic ions with $j = \frac{1}{2}, \frac{3}{2}$ and $\frac{5}{2}$. These tables are needed in connection with experiments on adiabatic demagnetization. As a by-product, the thermodynamic functions for an Einstein oscillator are computed numerically to a higher degree of accuracy than in the tables available in the literature.

470 536.758

On some properties of Bose–Einstein gases. GOLDSTEIN, L. *J. Chem. Phys.*, 9, *pp.* 472–479, *June*, 1941.—The condition which has to be fulfilled in order that the Bose–Einstein condensation be accompanied by a discontinuity of the heat capacity at the condensation temperature is discussed. The nature of the transition depends on the distribution of the energy levels of the individual particles forming the gas. The condensation is studied for several types of individual energy spectra. It is shown that all those Bose–Einstein (B.E.) assemblies which admit a non-ambiguous definition of the statistical distribution function present, beside interesting analogies, a qualitatively different behaviour from that observed in liquid He. It appears that, as long as the transition in momentum space of non-ideal B.E. systems is not understood, the possibility of connection between B.E. condensation and the transition observed in liquid He remains an open problem.

471 536.758

Statistical thermodynamics of several halomethanes. EDGELL, W. F., AND GLOCKLER, G. *J. Chem. Phys.*, 9, *pp.* 484–485, *June*, 1941.—The heat capacities of methyl fluoride and methyl iodide at several temperatures are calculated to the rigid-rotator simple harmonic oscillator approximation.

472 536.77

Thermodynamic functions for molecules with internal rotation. PITZER, K. S., AND GWINN, W. D. *J. Chem. Phys.*, 9, *pp.* 485–486, *June*, 1941.

See Abstr. 507 536.77 : 541.123.4 : 539.133

473 536.77 : 541.8

Thermodynamic properties of binary solid solutions. Phase separation. LASSETTRE, E. N., AND HOWE, J. P. *J. Chem. Phys.*, 9, *pp.* 801–806, *Nov.*, 1941.—A previously developed method [Abstr. 218 (1942)] of calculating the thermodynamic functions of a mixture is further examined. For a lattice which is large in at least 2 dimensions it is shown that the largest eigenvalue of the fundamental matrix is doubly degenerate over a finite temperature range, and within this range a separation into phases takes place. An approximation to the phase boundary which is valid at low temperatures is obtained.

ELECTRICITY

474 537.226 : 621.315.616.98

Some measurements on the validity of the principle of superposition in solid dielectrics. SILVA, H., AND GROSS, B. *Phys. Rev.*, 60, *pp.* 684–687, *Nov.* 1, 1941.—[Abstr. 282 B (1942)].

475 537.226.1

Change in the dielectric constant of liquids due to flow. PRASAD, S. P., SINGH, B., AND SINGH, B. N. *Sci. and Cult.*, 7, *pp.* 119–120, *Aug.*, 1941.

476 537.226.2 : 539.133 : 541.634 : 535.338

Electric polarization and molecular vibrations: the ethylene dihalides and diacetyl. BLOOM, G. I. M., AND SUTTON, L. E. *J. Chem. Soc.*, *pp.* 727–742, *Nov.*, 1941.—In continuation of work on anomalous polarization, some compounds which might show large vibration polarizations, either independent of or varying with temperature, have been examined in solution at 25° and also in the vapour phase over a range of temperature. A theory that there is an

equilibrium between *cis*- and *trans*-isomers predicts that the graph of the log. of the ratio of their amounts plotted against $1/T$ should give a straight line. Such lines have actually been obtained. An analysis of other authors' data for similar compounds in various solvents also gives straight lines. It is emphasized, however, that these observations do not exclude the possibility of restricted rotation about the *trans*-position. It is shown that the dipole data, like electron-diffraction data, disagree with the interpretation of the Raman spectra of acetylene tetrachloride and of cyclohexane, as signifying that for these molecules there are stable isomers in which non-bonded atoms approach as closely as possible. If the "*trans*-vibration" theory be accepted, the numerical results confirm the conclusions of previous workers, that the forces between the two rotatable halves of ethylene dihalide molecules are mainly steric forces, and that the repulsion is greater the larger the halogens. The planar fixation in diacetyl indicates resonance.

H. H. HO.

See Abstr. 573 537.226.2 : 541.133

See Abstr. 636 537.228.1 : 548

477 537.311.33 : 621.314.63

Transitional resistances of semi-conductors. DAVYDOV, B. *J. Phys., U.S.S.R.*, 4, 4, *pp.* 335–339, 1941.—A theoretical paper. The contact resistance of a semi-conductor and a metal plate has been calculated for currents of any magnitude. It is assumed that the conductivity electrons have thermal energy only. The calculation does not apply to Cu_2O rectifiers. The inner transitional resistances of a polycrystalline semi-conductor are considered. They may sometimes decrease with increase of current intensity. A. J. M.

See Abstr. 417 537.312.5 : 535.215.4 : 621 : 383.8 : 621.314.63

478 537.312.62

The behaviour of thin superconducting films in magnetic fields. ALEKSEYEVSKI, N. E. *J. Phys., U.S.S.R.*, 4, 5, *pp.* 401–410, 1941.—The effect of magnetic fields on thin superconducting films of pure Sn ($2{\cdot}36 \times 10^{-5}$ to $1{\cdot}55 \times 10^{-6}$ cm. thick) obtained by condensation at the temperature of liquid He was investigated. Directly after condensation, films have considerably higher critical fields than after they have been heated to room temperature. The critical field is plotted against temperature, and against thickness at 2° abs. The films have larger critical fields than massive Sn, and the critical field increases the thinner the film. A. J. M.

479 537.312.8

The electrical resistance of the alloy $AuCu_3$ in a transverse magnetic field and the order of arrangement of the atoms. KOMAR, A. *J. Phys., U.S.S.R.*, 4, 6, *pp.* 547–551, 1941.—For a $AuCu_3$ alloy $\Delta r_1/r_T$ was investigated as a function of the degree of order and of the magnetic field intensity at room temperature and at the b.p. of liquid N_2. It is shown that $\Delta r_1/r_T$ is a considerably more sensitive indicator of the degree of order than is the sp. resistance. Over the range of the measurements the above function satisfies a square law. The anisotropy of collision duration and the effective electron mass vary essentially during the transition of the alloy from a disordered to an ordered state. Kohler's rule is satisfied for the ordered but not for the disordered state. A. W.

480 537.321 : 539.4.016

Thermo-electric study of the cold-working and annealing of Cu. BRINDLEY, G. W. *Proc. Leeds Phil. Lit. Soc.*, 4, *pp.* 1–12, *July*, 1941.—A study was made for cold-rolled Cu of (1) the variation of thermal e.m.f. with degree of cold-working, and (2) the use of the thermal e.m.f. as an indicator of the state of the metal when cold-worked and then subjected to heat treatment. The thermal e.m.f. is shown to increase in a non-linear manner with % reduction, the increase being rapid as the reduction tends to 100%. The latter fact may, if true for other metals, explain some of the discrepancies in earlier work on this subject, since cold-working to different degrees would give widely differing thermal e.m.f.'s. Comparison of specimens cold-rolled to 90% reduction and heated for 20 hr. successively at 80°, 100°, 120°, 142° and 163°C., with other specimens of the same material heated directly to these temperatures, show that the thermal e.m.f.'s depend only on the highest temperature reached and not on previous heatings at lower temperatures. Partial recovery from the effects of cold-rolling is shown to occur slightly even at room temperature. Results are given for various temperatures between 80° and 305°C. Recovery is found to set in more rapidly and to be completed more quickly the greater the degree of cold-working. The effect of previous cold work on the final state of the metal after full annealing is indicated by the residual e.m.f.'s, which are unaffected by further heating. The residual e.m.f. is greater the more highly worked the metal. These results are similar in many respects to those of Alkins and Cartwright on the tensile strength of cold-drawn Cu wires after annealing treatments. A. W.

481 537.323

Thermo-electromotive force of bismuth thin films. YAMAGUTI, Z. *Electrotechn. J.*, 5, *pp.* 52–55, *March*, 1941.

482 537.525

The stationary cathode spot of a low-pressure mercury arc discharge. CHAUDHRI, R. M., AND KHAN, A. Q. *Curr. Sci.*, 10, *pp.* 435–436, *Oct.*, 1941.

483 537.525.8

On the applications of glow-discharge in metallurgy. SAITO, Y. *Electrotechn. J.*, 5, *p.* 80, *April*, 1941.

484 537.525.8

Stepped discharge in argon and helium. NOMOTO,

H. *Electrotechn. J.*, 5, *pp.* 72–74, *April*, 1941.—The stepped curves of V and I for A and He gases in discharge tubes at low pressures are examined experimentally. The curve for He slopes downwards, unlike those for other gases, and the difference between normal cathode drop for dynamic and static glow is only 10% of that for other gases. The characteristic is modified by changes of gas, pressure and electrode distance and material. E. H. W. B.

485 537.525.8

Distribution of energy among the cathode rays of a glow discharge. CHAUDRI, R. M. *Nature, Lond.*, 148, *pp.* 727–728, *Dec.* 13, 1941.

486 537.531 : 535.3

Diffuse spots in X-ray photographs. BRAGG, W. H. *Nature, Lond.*, 148, *p.* 780, *Dec.* 27, 1941.

487 537.531 : 535.3

On the theory of temperature diffuse scattering. ZACHARIASEN, W. H. *Phys. Rev.*, 60, p. 691, *Nov.* 1, 1941.—Corresp. [Abstr. 2110 (1941) and 1586 (1940)].

See Abstr. 505 537.533.7 : 539.132

488 537.533.74

Elastic scattering of fast electrons by nitrogen nuclei. CHAMPION, F. C. *Nature, Lond.*, 148, *p.* 727, *Dec.* 13, 1941.

489 537.533.8 = 3

Theory of secondary electron emission from dielectrics and semi-conductors. KADYSCHEWITSCH, A. E. *J. Phys., U.S.S.R.*, 4, 4, *pp.* 341–348, 1941.—The theory of secondary electron emission from dielectrics and semi-conductors is developed from a consideration of that from metals. The coefficients and positions of the max. secondary emission were obtained as a function of the energy. The dependence of the emission on the emission work and the inner potential is investigated. A. J. M.

490 537.534.74

The scattering of protons by protons from 200 to 300 ekV. RAGAN, G. L., KANNE, W. R., AND TASCHEK, R. F. *Phys. Rev.*, 60, *pp.* 628–640, *Nov.* 1, 1941.—Proton-proton scattering between 200 and 300 ekV has been studied as a function of energy and of angle. The results are in good agreement with Breit's calculations based on a square well proton-proton interaction potential of e^2/mc^2 radius and 10·500 eMV depth. The scattering chamber was isolated from the accelerating tube by a differential pumping system. Scattered protons were detected by Geiger–Klemperer proportional counters filled with purified H. Two separate counters connected to similar amplifier-recorder circuits detected simultaneously protons scattered at different angles from the beam, and the ratio of scattering at these angles was calculated directly. Tests of the performance of the counters are given. Two different scattering chambers yielded similar results.

491 537.565

On the momentum loss of heavy ions. BRUNINGS, J. H. M., KNIPP, J. K., AND TELLER, E. *Phys. Rev.*, 60, *pp.* 657–660, *Nov.* 1, 1941.—In the calculation of the momentum loss of a heavy ion in its passage through matter, an estimate is needed of the charge of the ion as a function of its velocity. The process of capture and loss of electrons in collisions is characterized by the velocity within the ion of the electron or electrons participating. This velocity is roughly proportional to the ion velocity. The factor of proportionality is introduced as a convenient parameter. Two methods are used to estimate the charge of the ion: (1) It is supposed that the characteristic velocity is that of the energetically most easily removable electron, which is determined from the Thomas–Fermi model. (2) It is supposed that the characteristic velocity is that of the outermost electron, which is also calculated from the Thomas–Fermi model. The characteristic velocity probably lies between these extremes.

492 537.581

A new method of measuring thermionic constants of oxide-coated cathodes. SANO, S. *Electrotechn. J.*, 5, *pp.* 78–79, *April*, 1941.

493 537.591.5 : 550.385

Cosmic rays and the magnetic disturbance of September 18, 1941. HESS, V. F., AND BERRY, E. B. *Phys. Rev.*, 60, *p.* 746, *Nov.* 15, 1941.

494 537.71 : 621.3.081.5

Note on electric and magnetic dimensions. YARNOLD, G. D. *Proc. Phys. Soc., Lond.*, 54, *pp.* 46–50, *Jan.*, 1941.—[Abstr. 233 B (1942)].

495 537.723 : 621.317.33.082.74

The absolute measurement of electrical resistance by a method using the average e.m.f. of a commutating generator. NETTLETON, H. R., AND BALLS, E. G. *Proc. Phys. Soc., Lond.*, 54, *pp.* 27–46, *Jan.*, 1942.—[Abstr. 296 B (1942)].

496 537.723.2 : 621.317.332

A method for the measurement of impedance by means of Lecher wires. FLINT, H. T., AND WILLIAMS, G. *Phil. Mag.*, 32, *pp.* 489–495, *Dec.*, 1941.—[Abstr. 297 B (1942)].

MAGNETISM. ELECTROMAGNETISM

497 538.1

Magnetic moments at high frequencies. PAGE, L. *Phys. Rev.*, 60, *pp.* 675–684, *Nov.* 1, 1941.—The magnetic moments of conducting, permeable spheres and cylinders in an oscillating magnetic field are calculated as functions of the conductivity, permeability, radius of cross-section and wavelength. The electric moment of a conducting sphere in an oscillating electric field is obtained. The results are applied to the determination of the effect of particle size on the effective permeability of magnetic powders.

498 538.214

Magnetic susceptibility of strontium. Rao, S. R., and Savithri, K. *Curr. Sci.*, 10, *p.* 363, *Aug.*, 1941.

499 538.224

Diamagnetic susceptibility of methane. Coulson, C. A. *Proc. Phys. Soc., Lond.*, 54, *pp.* 51–54, *Jan.*, 1942.—Theoretical calculations of the diamagnetic susceptibility of methane have been made on the basis of the molecular-orbital and electron-pair approx. wave functions. The results are compared with the self-consistent-field value, and it is shown that in this latter an error of about 25% is due to the preliminary averaging of the positive charges on the 4 protons. The new values agree well among themselves, but are still considerably larger than the experimental value. The reasons for this are briefly discussed.

500 538.24 : 621.318.34

Effect of elastic stresses on magnetization processes in ferromagnetics in weak fields. Drožžina, V. I., and Shur, J. S. *J. Phys., U.S.S.R.*, 4, 5, *pp.* 393–399, 1941.—[Abstr. 298 B (1942)].

501 538.563 : 621.396.611.2 = 4

On phase selectivity. Gorélik, G. *J. Phys., U.S.S.R.*, 4, 1–2, *pp.* 57–58, 1941.—[Abstr. 342 B (1942)].

502 538.566.3 : 621.396.11

Measurement of the angle of incidence at the ground of downcoming short waves from the ionosphere. Lal, C. *Indian J. Phys.*, 15, *pp.* 289–305, *Aug.*, 1941. —[Abstr. 338 B (1942)].

503 538.615 : 535.338

Zeeman-effect data and preliminary classification of the spark spectrum of praseodymium—Pr II. Rosen, N., Harrison, G. R., and McNally, Jr., J. R. *Phys. Rev.*, 60, *pp.* 722–730, *Nov.* 15, 1941.—The Zeeman effect of Pr was studied at fields up to 95 000 oersteds over the range 2 400 to 7 100 Å. Values of g and J were determined for 74 Pr II levels from resolved Zeeman patterns of 141 lines. With these data, together with new wavelength data, a quadratic-term array was set up which accounts for 312 lines. This array is consistent with King's temperature classification of the lines and with all previous hyperfine-structure observations. It is self-consistent in g values to an average deviation of 0·005 unit, and in wave numbers to an average deviation of 0·08 cm.$^{-1}$ Previously published hyperfine-structure measurements were found insufficiently precise to aid the classification, but were of value in its verification.

MOLECULAR AND ATOMIC PHYSICS

See Abstr. 439 539.13 : 535.338

504 539.132

The partition functions of molecules with internal torsion. I. Single asymmetric top attached to rigid framework. Price, D. *J. Chem. Phys.*, 9, *pp.* 807–815, *Nov.*, 1941.—Crawford's method of treating pseudo-rigid molecules [Abstr. 1413 (1940)] is extended to the case involving an asymmetric top. The exact classical kinetic energy for a molecule consisting of a rigid framework to which asymmetric tops are attached is given. From this the quantum-mechanical operator is derived for the case of one top of small moment of inertia and of small asymmetry. The energy matrix for the molecule is obtained from the operator; and, by use of a perturbation method, the partition function for translation, overall rotation and internal rotation, correct to the second order, is obtained from the matrix. This includes effects due to translational and angular momentum couplings.

505 539.132 : 537.533.7

Momentum distribution in molecular systems. VI. Shape of the Compton line for methane CH_4. Coulson, C. A., and Duncanson, W. E. *Proc. Camb. Phil. Soc.*, 38, *pp.* 100–108, *Jan.*, 1942.—[See Abstr. 2198 (1941)]. Calculations have been made of the momentum distribution and the shape of the Compton profile for gaseous methane, using the Dirac transformation theory and 3 distinct approximations (molecular orbital, electron-pair and self-consistent field) to the true molecular wave functions. The bearing of the results upon the validity of the original wave functions is discussed; it is concluded that the exponents in molecular wave functions should be approx. 1·1 times greater than in corresponding atomic wave functions. Comparison is made with experimental electron-scattering results.

506 539.133

Relativistic dynamics of a spinning magnetic particle. Mathisson, M. *Proc. Camb. Phil. Soc.*, 38, *pp.* 40–60, *Jan.*, 1942.—The author's general variational method [Abstr. 2582 (1940)] is applied to the case of a particle for which second moments are important but third and higher moments are negligible. Equations of motion are obtained for the angular momentum and for the centre of mass with arbitrary external forces. The angular forces are then calculated for a charged particle with electric and magnetic moments moving in a general electromagnetic field, on the assumption that the effect of a certain part of the energy tensor is negligible. This leads to the equations of angular motion, from which it is inferred that, in order that the magnitude of the angular momentum may be integrable, the angular momentum, electric and magnetic moments, must all be parallel in a frame of reference in which the particle is instantaneously at rest. The linear forces are then calculated for the case of no electric moment, leading to the equations for linear motion. From these it is inferred that, in order that the mass may be integrable, the ratio of the magnetic moment to the angular momentum must be constant.

507 539.133 : 536.77 : 541.123.4

High rotational levels and the partition function for hydrogen. WOOLLEY, H. W. *J. Chem. Phys.*, 9, *pp.* 470–472, *June*, 1941.—The ordinary formula for the rotational energy of a simple rotating vibrator, when applied to a diatomic molecule, consists of the first few terms of a series that becomes poorly convergent for levels of high rotational energy. Inversion of the series results in a better approximation. An illustration is given using the results of calculations for the normal state of hydrogen. The inverted series is especially suited to derivation of approximation formulae for the partition function. Such an approx. formula should not be carried to powers of T so high that lack of coefficients for the ordinary formula introduces significant error.

See Abstr. 469 539.133 : 541.123.4 : 536.75

See Abstr. 476 539.133 : 541.634 : 535.338 : 537.226.2

508 539.152.1

Physical concepts of the meson theory of the atomic nucleus. HEITLER, W. *Nature, Lond.*, 148, *pp.* 680–683, *Dec.* 6, 1941.—A review. The development of the meson theory is considered, and the calculation of the value of the universal constant g is given. The probability of finding a meson at a given distance from a proton is calculated. The qualitative explanation of the anomalous magnetic moment of the proton and neutron is discussed. The β-decay of the meson is mentioned. A. J. M.

509 539.153 : 539.166.2

On the spectroscopy of heavy nuclei. II. Rotation and magnetic excitation levels of heavy nuclei in conjunction with soft γ-rays. FRENKEL, J. *J. Phys., U.S.S.R.*, 4, 6, *pp.* 493–498, 1941.—The scheme of Guggenheimer for explaining low-lying excitation levels (30–368 ekV), as corresponding to a rotation of the nucleus as a solid body, is examined from the point of view of the symmetry of heavy nuclei and the possibility of explaining metastable and isomeric states. The magnetic and gyromagnetic splitting due to the rotation of the nucleus as a whole on the orientation of the unpaired proton or neutron in odd nuclei is considered. This effect gives rise to low-lying excitation levels of relatively short mean life. A. J. M.

510 539.155.2

Isotopic weights of sulphur and titanium. OKUDA, T., AND OGATA, K. *Phys. Rev.*, 60, *pp.* 690–691, *Nov.* 1, 1941.

511 539.155.2

The mass differences of the fundamental doublets used in the determination of the isotopic weights C^{12} and N^{14}. JORDAN, E. B. *Phys. Rev.*, 60, *pp.* 710–713, *Nov.* 15, 1941.—The values of the mass of C^{12} as determined by different observers show a discrepancy well outside the corresponding probable errors. This mass is used in the determination of other isotopic weights. Fundamental to its determination is the mass difference $C^{12}H_4$–O^{16}; a new determination of this mass difference has been made with a large spectrograph. In addition, the $C^{12}H_2$–N^{14} mass difference has been checked by means of the doublets $C^{12}H_3$–$N^{14}H$ and $C^{12}H_4$–$N^{14}H_2$.

512 539.16.08

A calculation of the error due to the absence of guard electrodes in X-ray ionization chambers. WALBRIDGE, N. L. *Rev. Sci. Instrum.*, 12, *pp.* 546–548, *Nov.*, 1941.—An equation was derived for the fraction Q of the incident X-ray power P which escapes as kinetic energy of electrons. This equation can be used to eliminate the necessity of guard electrodes.

513 539.16.08

The determination of radium in some igneous rocks. FØYN, E., GLEDITSCH, E., AND ROSENQVIST, I. T. *Amer. J. Sci.*, 239, *pp.* 805–808, *Nov.*, 1941.

514 539.162

Calculation of activities of radioactive substances in series disintegrations. HULL, D. E. *J. Phys. Chem.*, 45, *pp.* 1305–1312, *Nov.*, 1941.—The author presents a set of formulae which enable one to calculate quickly the activity of any member of the 3 naturally occurring radioactive series at any time after any arbitrary initial conditions.

515 539.163

Radioactive isotopes of mercury. WU, C. S., AND FRIEDLANDER, G. *Phys. Rev.*, 60, *pp.* 747–748, *Nov.* 15, 1941.

516 539.164.81 539.165.8

Ionization of atoms accompanying α- and β-decay. MIGDAL, A. *J. Phys., U.S.S.R.*, 4, 5, *pp.* 449–453, 1941.—The probability of ionization of the inner electron shells accompanying α- and β-decay is calculated. In the case of β-decay, use is made of the fact that the velocity of a β-decay electron is usually great compared with the velocities of atomic electrons. A similar method cannot be employed for α-decay in the case of inner shells, since the velocities of α-particles are smaller than those of the electrons in these shells. In the case of α-decay the ionization probability decreases with energy rather more rapidly than for β-decay. The ionization of outer shells accompanying α-decay can, however, be calculated by a method similar to that employed for β-decay. A. J. M.

517 539.165.8

Ionization of the atom due to β-decay. FEINBERG, E. L. *J. Phys., U.S.S.R.*, 4, 5, *pp.* 423–438, 1941.—A theoretical paper. The change of state of an atomic core due to β-decay of the nucleus is considered, with special reference to the ionization of the K-level. Non-relativistic treatment yields results similar to

those obtained by more general relativistic treatment in the case of comparatively fast β-particles. A. J. M.

See Abstr. 516 539.165.8

518 539.166.2

Energies of gamma-rays from Ni^{63}, Mn^{56}, Zn^{69}, Ga^{67}. GUTHRIE, A. *Phys. Rev.*, 60, *pp.* 746–747, *Nov.* 15, 1941.

See Abstr. 509 539.166.2 : 539.153

519 539.166.831

Range of the photo-fission fragments of uranium produced by the γ-ray of lithium bombarded with protons. ARAKATSU, B., SONODA, M., UEMURA, Y., AND SHIMIZU, S. *Proc. Phys.-Math. Soc. Japan*, 23, *pp.* 633–637, *Aug.*, 1941.—The range of photo-fission fragments from U nuclei irradiated by 17 eMV γ-rays is approx. 1·30 cm. in air. Experimental details are given. The energy of the fission fragments can be calculated on the basis of a number of assumptions, all of which give a value less than 28 eMV which is much less than that expected from mass-defect considerations (about 200 eMV). A. J. M.

520 539.166.93

Autoradiography of ores. GOODMAN, C., AND PICTON, D. C. *Phys. Rev.*, 60. *p.* 688, *Nov.* 1, 1941.

521 539.167.3

Artificial radioactive isotopes of thallium, lead and bismuth. FAJANS, K., AND VOIGT, A. F. *Phys. Rev.*, 60, *pp.* 619–625, *Nov.* 1, 1941.—The radio-elements produced by deuteron and neutron bombardment of Tl and Pb have been investigated. The cloud chamber was used to observe the sign of the particles and the energies were determined from absorption measurements. A low-intensity 65 min. Pb isotope is formed by the deuteron bombardment of Tl; it emits γ-rays and electrons of 1·00 eMV energy. The properties of 2 radio-elements reported in a preliminary note have been more thoroughly studied. The long-lived Tl isotope produced by deuteron and neutron bombardment of Tl has a $\frac{1}{2}$-life of $3{\cdot}5 \pm 0{\cdot}5$ years; it emits negative β-particles with a max. energy of 0·87 eMV. The provisional assignment is to Tl^{206}. The 52 hr. Pb isotope from the deuteron bombardment of Tl emits γ-rays (450 ekV), conversion electrons (370 ekV), and X-rays (95 ekV). Its assignment is uncertain. Two activities first obtained by others from the deuteron bombardment of Pb have been studied. The $\frac{1}{2}$-life of the 3 hr. Pb was measured as $3{\cdot}32 \pm 0{\cdot}03$ hr. and its β-ray energy as 0·70 eMV. The 6·4-day Bi was found to emit γ-rays of 1·1 eMV and electrons of 0·86 eMV. The excitation functions for these 2 activities were measured; that for the 6·4-day Bi indicates that a *d–n* reaction is responsible for its production. The recently reported 10 min. positron activity in Pb and 18 hr. Bi activity could not be confirmed.

522 539.167.3

The use of uranium lead in the assignment of artificial radioactive isotopes. FAJANS, K., AND VOIGT, A. F. *Phys. Rev.*, 60, *pp.* 626–627, *Nov.* 1, 1941.—[See Abstr. 521 (1942)]. Uranium Pb and ordinary Pb were bombarded with deuterons under the same conditions in order to establish from which of the stable Pb isotopes the 3·3 hr. Pb and 6·4-day Bi activities are produced. The intensities of the resulting radio-elements were compared with the abundances of the isotopes. The 3·3 hr. Pb was found to be produced from Pb^{208} and the reaction must be Pb^{208}, *d–p*, Pb^{209}. The 6·4-day Bi is produced from Pb^{206}. Its assignment depends on the type of reaction; the more probable one is Pb^{206}, *d–n*, Bi^{207}.

523 539.17

On the resonance level of Hg at negative energy. KIMURA, M. *Phys. Rev.*, 60, *pp.* 688–689, *Nov.* 1, 1941.

524 539.17

Long-lived activity of rhodium. MINAKAWA, O. *Phys. Rev.*, 60, *pp.* 689–690, *Nov.* 1, 1941.

525 539.185

The scattering of fast neutrons by lead. DUNLAP, H. F., AND LITTLE, R. N. *Phys. Rev.*, 60, *pp.* 693–701, *Nov.* 15, 1941.—The scattering of D–D neutrons by Pb was investigated with a cloud chamber. The energy distribution of the inelastically scattered neutrons was determined from 0·6 to 2·0 eMV, and it was found that the distribution does not agree with the theoretical predictions. The cross-section for inelastic scattering was determined, and is $1{\cdot}31 \pm 0{\cdot}53 \times 10^{-24}$ cm.^{2}. It is shown that elastic scattering is not spherically symmetric, and is very small for angles greater than about 50°.

526 539.185.9

The interaction of slow neutrons with nuclei. CARROLL, H. *Phys. Rev.*, 60, *pp.* 702–709, *Nov.* 15, 1941.—The influence of the molecular binding of the proton has been investigated by measuring the total cross-section per proton, for neutrons absorbed by Cd (C neutrons), of a series of gaseous hydrocarbons of the form C_nH_{2n+2}. The measurements were also extended to include gaseous H_2, ordinary water and solid paraffin. The results show that the cross-section per proton increases rapidly from the value for the free proton, varying roughly as the square of the reduced mass of the system. The bound-proton cross-section as measured for the highest hydrocarbon (paraffin) approaches a limiting value of 2·4 times that for the free proton. The dependence of neutron scattering on structure was investigated from measurements on cetane in its liquid and solid states. The marked increase in the cross-section of the liquid state over the solid state indicates that a large amount of coherent scattering must be present. The total cross-sections of the deuteron in heavy water, and of He, Ne, A, Kr, O and N, in the gaseous state, were also measured.

527 539.2

Researches on the structure of alloys. HUME-ROTHERY, W. *Res. Rep. R.R.A.* 562 *Brit. Non-Ferr. Met. Res. Assoc.*, [21 *pp.*], *June*, 1941.—A summary of a series of researches, with a list of the separate papers published by the author and his collaborators since 1934.

See Abstr. 614 539.2 : 621.315.616 : 541.6

528 539.214

Working-range flow properties of thermoplastics. WILEY, F. E. *Industr. Engng Chem.*, 33, *pp.* 1377–1380, *Nov.*, 1941.—A test to measure the working-range flow properties of thermoplastics is described, and data obtained by this test are presented. The apparatus is simple and may be readily constructed.

529 539.215 : 539.61 = 3

On filtration capacity and liquid absorption of sediments. BUZÁGH, A. VON, AND ERÉNYI, E. *Kolloid Z.*, 91, *pp.* 191–196, *May*, 1940.—The investigations refer to the changes in filtration capacity and liquid absorption engendered by structural changes of a sediment due to different degrees of adhesion. Homodispersed quartz powders in electrolytes of different ion valencies and different concentrations were investigated. The curves of filtration capacity, absorption and sediment value, *v.* concentration, have a parallel trend and the valencies play a distinct part. If plotted against the activity coefficient an S-shaped curve results, common to the salt types with mono- and bivalent cations. This indicates a close relation between these properties and the adhesion. With increasing adhesion the porosity, and therefore the filtration capacity and liquid absorption, of the sediment increase. Salts effecting a change of charge with quartz show max. values in the concentration curves at the iso-electric point. R. N.

530 539.215.4

Commercial insecticidal sulphurs. GOODEN, E. L. *Industr. Engng Chem.*, 33, *pp.* 1452–1453, *Nov.*, 1941.—A survey of commercial insecticidal powdered sulphurs with regard to average diameters (surface mean diameters) has been made by means of the self-calculating air-permeation apparatus. In the 54 samples tested, the average diameters range from 5 to 25 μ. The plain sulphurs occupy mainly the upper half of the range, and the wettable and conditioned sulphurs the lower half.

531 539.215.4

Applications of particle-size analysis. RICHARDSON, E. G. *Nature, Lond.*, 148, *pp.* 714–716, *Dec.* 13, 1941.—Attention is directed to the increasing number of applications of methods for the delineation of the size-frequency curve of a substance in amorphous form in the spheres of applied physics and chemistry. It is stated that the photo-extinction method, in which the weight of a sample is estimated by casting a beam of light athwart a settling tank during sedimentation to fall on a photo-electric cell, is probably the most accurate as well as the most convenient of those devised, particularly for quite small quantities. Applications to powders are first described, data are supplied for particle-size analyses of commercial flows, and effective critical sizes such as are found in the dust problem in mines, silicosis, pigment colours which reach a max. brilliance for a certain grain size, insulating plasters, phosphor powders and concrete, are briefly discussed. Applications to liquid pastes and suspensions, and in natural phenomena, such as the granularity of sediments put down by natural agencies, e.g. winds and rivers, are described.

H. H. HO.

532 539.215.9

Clay and soil mechanics. MINIKIN, R. R. *Engineering*, 152, *pp.* 241–243, *Sept.* 26, *and pp.* 261–262 *and* 263, *Oct.* 3, 1941.—After describing the properties of clay and its behaviour to wetting and drying conditions, the author considers the stability of the sides of cuttings in clay strata for making embankments with clay, but it is important that the lumps should be small, and excavation by spade yields better material than power excavators. Experimental results can be applied to the design of foundations by using the law of model similarity. On this basis the rate of settlement can be predicted. The paper closes with a discussion of methods of pile-driving in various clay soils. W. A. R.

See Abstr. 403 539.217.5 : 533.15

533 539.219.2 : 621.791 = 3

On the cause of welding defects in steel for aircraft construction. MÜLLER, J. *Luftfahrtforschung*, 17, *pp.* 97–105, 1940. *Abstr. in VDI* [*Z. Ver. dtsch. Ing.*], 85, *p.* 28, *Jan.* 4, 1941.—[Abstr. 475 B (1942)].

534 539.26

X-ray studies on the hydrous oxides. X. Anatase and rutile modifications of titania. WEISER, H. B., MILLIGAN, W. O., AND COOK, E. L. *J. Phys. Chem.*, 45, *pp.* 1227–1234, *Nov.*, 1941.—The rate of transformation of the more soluble and less stable anatase modification of titania into the less soluble and more stable rutile modification is influenced by two opposing factors: (*a*) retardation of the transformation by an adsorbed layer of ions on the anatase, which reduces its rate of solution, and (*b*) acceleration of the transformation by an ionic environment in which anatase is more soluble. Anatase formed by the hydrolysis of $TiCl_4$ or $Ti(NO_3)_4$ solutions is transformed fairly rapidly into rutile at 100°C. The rate of transformation is slowed down enormously in the presence of a large excess of alkali chloride or nitrate, because of the protective action of adsorbed anions. The rate of transformation is speeded up in the presence of excess HCl or HNO_3, because of increased solubility of anatase, in spite of the protective action of adsorbed ions. Anatase formed by the

hydrolysis of $Ti(SO_4)_2$ solution is not transformed into rutile in any reasonable time even in strong H_2SO_4 solutions, since sulphate ions are adsorbed much more strongly than univalent chloride and nitrate ions.

535 539.26

Precipitation hardening in the Fe–W system. SMITH, C. S. *J. Appl. Phys.*, 12, *pp.* 817–822, *Nov.*, 1941.—An X-ray study has been made of precipitation-hardened, 7·16% tungsten, Fe–W alloys. It is concluded that the precipitation reaction is of the discontinuous type. On the basis of diffraction evidence a mechanism for the formation and growth of the precipitate is proposed and a picture of the crystallographic form of the precipitate deduced.

536 539.26

A preliminary X-ray study of binary alloys of platinum with cobalt, molybdenum and tungsten. HULTGREN, R., AND JAFFEE, R. I. *J. Appl. Phys.*, 12, *pp.* 501–502, *June*, 1941.—At the composition PtCo there exists a tetragonal superlattice with the AuCu structure. It is stable at 600°C., but forms a face-centred-cubic disordered phase at 1 000°C. It is the incipient formation of this superlattice which is responsible for the superlative remanence and coercivity reported by Jellinghaus. At 400°C. a body-centred cubic phase begins to form. More than 50 atom. % Mo and more than 35 atom. % W are soluble in Pt at 1 000°C.

537 539.26 : 539.4.016.2 : 539.52

Notes on an X-ray investigation into cold-rolled magnesium alloy sheet. FROMMER, L. *J. Inst. Met.*, 67, *pp.* 361–368, *Dec.*, 1941.—Specimens of Dow metal sheet, cold-rolled in 1 direction to extensions ranging from 2 to 50%, have been subjected, in the cold-rolled state and after annealing at 350°C. for 1 hr., to tensile tests parallel and transverse to the direction of rolling, and to X-ray investigation. Above 5% cold extension the tensile properties exhibit a strong directionality in the as-rolled state; in particular, the ductility is much lower parallel to the rolling direction than transverse to it. Annealing greatly diminishes this directionality. X-ray patterns obtained with Mo-radiation transmitted through specimens in the 3 main directions show, in all cases, a strongly preferred orientation approaching a fibre structure, the hexagonal axes preferring positions approx. normal to the sheet surface, with deviations up to about $\pm 30°$. In specimens cold-rolled to higher degrees the range of deviation parallel to the rolling direction is markedly greater than the range transverse to the rolling direction, in both the as-rolled and the annealed state. The occurrence of this disparity does not correspond with that of the mechanical directionality and it is therefore not the primary cause of the latter. Glancing-reflection exposures were taken with Fe-*K* radiation in a setting which gave patterns enabling the (002) reflection spots of the individual grains to be recognized separately. These patterns indicate that, in cold-rolling, the basal planes of the original grains suffer curving and buckling preferentially around axes transverse to the direction of rolling. It is suggested that this may, perhaps, contribute to an explanation of the directionality of the ductility.

538 539.261 : 539.381

Film-contraction errors in lattice-spacing measurements. HUME-ROTHERY, W., RAYNOR, G. V., AND LITTLE, A. T. *J. Sci. Instrum.*, 18, *pp.* 239–240, *Dec.*, 1941.—Most modifications of the Debye–Scherrer method for the determination of lattice spacings involve the assumption that the film expands and contracts uniformly during the developing and drying process, and that no changes in length occur during the actual exposure. The validity of these assumptions is discussed, and examples given of cases in which errors were introduced owing to changes in the length of the film during the exposure. A method for preventing this kind of error is described.

539 539.266

An X-ray study of liquid benzene, cyclohexane and their mixtures. BELL, P. H., AND DAVEY, W. P. *J. Chem. Phys.*, 9, *pp.* 441–450, *June*, 1941.—X-ray (Mo $K\alpha$) studies were made of pure benzene, pure cyclohexane and their mixtures, using a Geiger–Müller counter with balanced filters. The benzene showed at 25°C. a rather sharp intense peak at the customary 8° 40′ and a new broader peak of about $\frac{1}{8}$ intensity at 4° 20′. The cyclohexane showed a similar pair of peaks at 8° 0′ and 4° 0′. The mixtures all showed a broad peak of low intensity reaching from 4° 0′ to 4° 20′ and 3 sharp peaks at 8° 0′, 8° 20′ and 8° 40′ superimposed on a broad peak which reached from about 8° 0′ to about 8° 40′. The positions of the 3 sharp peaks were not affected by the proportions of the 2 components, and their relative intensities were independent of amount of stirring. The customary shift with temperature was observed on all peaks. An explanation is given.

540 539.266

Atomic distributions in liquid elements. GAMERTSFELDER, C. *J. Chem. Phys.*, 9, *pp.* 450–457, *June*, 1941.—Monochromatic X-ray diffraction patterns of liquid Cl, Sn, In, Zn, Cd, Al and Li, were obtained, using Mo $K\alpha$ radiation. The effect of temperature change on the patterns was determined for Sn and In. Fourier analyses of these patterns led to the determination of atomic distribution curves for each element. Each atom in liquid Cl has one nearest neighbour, which means that Cl is diatomic in the liquid state. The distribution curves for liquid Sn, Zn and Al agree very well with the distributions in the corresponding crystals, those for In, Cd and Li do not.

See Abstr. 637, 638, 639 539.3 : 548

541 539.31

Initial stress and elastic instability. JEFFREYS, H. *Proc. Camb. Phil. Soc.*, 38, *pp.* 125–128, *Jan.*, 1942.—Elastic constants vary somewhat with stress, and are different according as a stressed or unstressed state is taken as the standard. The author examines the stress in a body initially stressed and concludes that, within the accuracy of experiment and, usually, of the approximations made in the calculation, elastic instability depends only on the elastic constants for small strains, their variation with the strain need not be considered. G. E. A.

542 539.378.3 = 3

On absorption and diffusion of foreign atoms into the zinc sulphide lattice. RIEHL, N., AND ORTMANN, H. *Z. phys. Chem. A*, 188, *pp.* 109–126, *March*, 1941.—The diffusion of Cu, Ag, Mn and Fe atoms or ions, into the ZnS lattice is investigated. The results show that Cu and Ag atoms penetrate into the free interspaces; Ag atoms require a higher temperature. The simultaneous action of 2 different atoms, e.g. Cu and Ag, is also dealt with. Cu will displace Ag, but not vice versa. The diffusion of Mn is very different from that of Cu and Ag. A mixed crystal formed by substitution develops, but only at temperatures above 800°C. Fe atoms show an intermediate behaviour; they may either diffuse into the interspaces or be incorporated at the lattice points. R. N.

See Abstr. 538 539.381 : 539.261

543 539.382

Temperature dependence of Young's modulus and internal friction of lucite and karolith. RINEHART, J. S. *J. Appl. Phys.*, 12, *pp.* 811–816, *Nov.*, 1941.—The Young's modulus and specific energy loss of lucite and karolith were measured at different frequencies in the neighbourhood of 50 kc./s. as a function of temperature. The temperature range for lucite was from − 55°C. to 65°C., and for karolith, 25°C. to 110°C. It was found that the reciprocal of Young's modulus *v.* temperature curves showed positive curvatures at higher temperatures for both materials. At room temperature the Young's moduli were 4·72 and $6{\cdot}14 \times 10^{10}$ dynes/cm.^{2}, respectively. The specific loss was found to vary with frequency for both materials and varied in a linear fashion for lucite at room temperature. Absorbed water seemed to have a pronounced effect on the Young's modulus of karolith.

544 539.4.015.1

Effect of grain size and structure on carbon-molybdenum steel pipe. WHITE, A. E., AND CROCKER, S. *Trans. Amer. Soc. Mech. Engrs*, 63, *pp.* 749–757; *Disc.*, 757–764, *Nov.*, 1941.—Pipe specimens were obtained from 8 different heats of C–Mo steel, 6 being made by the open-hearth, and 2 by the electric-furnace process, and an attempt was made to correlate the respective creep strengths at 925°F. with other significant properties obtained through short-time tests. No apparent relationship was found. Further tests were conducted on heat-treated specimens from a single heat of steel which had been made by a preferred melting practice. From these tests it is evident that, if the carbide structures are of a Widmanstätten type, with grain sizes ranging from 2 to 7, the steels will have high-temperature creep properties superior to those in which the carbides are in other conditions or forms. It is also believed that too great an emphasis has been placed on grain size and not enough on type of carbide structure. It is felt that consideration should be given to both factors, though with greater emphasis on the type of carbide structure.

545 539.4.016

The rolling of a magnesium alloy. JONES, W. R. D., AND POWELL, L. *Engineering*, 152, *pp.* 345–346, *Oct.* 31, *and pp.* 405–406, *Nov.* 21, 1941.—[See Abstr. 785 B (1941)].

See Abstr. 480 539.4.016 : 537.321

See Abstr. 537 539.4.016.2 : 539.52 : 539.26

546 539.4.016.3

Note on the effect of heat-treatment on the true breaking stress of duralumin (6L1). DEARDEN, W. H. *J. Inst. Met.*, 67, *pp.* 357–360, *Dec.*, 1941.—The note records values obtained from data based on autographically recorded load/extension diagrams. The number of test pieces available was severely limited, but results are given for duralumin (*a*) as received, (*b*) annealed at 395°C., (*c*) aged at room temperature, and (*d*) aged at 145°C.

547 539.4.019 : 620.19 = 3

Corrosion behaviour of aluminium alloys of higher strength. GRÖBER, H. *Aluminium*, 22, *pp.* 231–247, 1940. *Abstr. in VDI [Z. Ver. dtsch. Ing.]*, 85, *pp.* 294–296, *March* 22, 1941.—[Abstr. 215 B (1942)].

548 539.431 = 3

The effect of service interruptions on the continuous-load and fatigue strength of metallic materials. BOLLENRATH, F., AND CORNELIUS, H. *VDI [Z. Ver. dtsch. Ing.]*, 84, *pp.* 295–299, *May* 4, 1940.—For various alloys of Al, Mg, Fe and Cu, and for practically pure Fe and Cu, the influence of repeated interruptions of 7 and 17 hours' duration during fatigue tests was investigated. No influence was detected. R. N.

549 539.431 : 620.19

Fretting corrosion and fatigue strength: brief results of preliminary experiments. WARLOW-DAVIES, E. J. *Proc. Instn Mech. Engrs, Lond.*, 146, *pp.* 32–38, *Nov.*, 1941.—[Abstr. 216 B (1942)].

550 539.434

Progress report on tubular creep tests. NORTON, F. H. *Trans. Amer. Mech. Engrs*, 63, *pp.* 735–736, *Nov.*, 1941.—In this investigation an attempt is made

to correlate the stress between the tensile specimens and the tubular specimens. The results indicate that the longitudinal creep of the tubes is substantially zero, and that the circumferential creep is approx. the same as the creep in the tensile specimen with a stress equivalent to the circumferential stress in the tube.

551 539.434

Interpretation of creep tests on tubes. SODERBERG, C. R. *Trans. Amer. Soc. Mech. Engrs*, 63, *pp.* 737–740; *Disc.*, 740–748, *Nov.*, 1941.—The paper contains a discussion of the phenomena involved in the light of the accepted theory of yielding, the theoretical basis for the research programme, and the significance of the results thus far obtained.

See Abstr. 537 539.52 : 539.4.016.2 : 539.26

552 539.54

Hardening of tellurium-lead alloys. *Engineer, Lond.*, 172 (*Metallurgist*), *pp.* 47–48, *Dec.* 26, 1941.

553 539.56

Brittleness in high-chromium steels. *Engineer, Lond.*, 172 (*Metallurgist*), *pp.* 43–46, *Dec.* 26, 1941.

See Abstr. 529 539.61 : 539.215

554 539.621

The electrostatic component of the force of sliding friction. SCHNURMANN, R., AND WARLOW-DAVIES, E. *Proc. Phys. Soc., Lond.*, 54, *pp.* 14–27, *Jan.*, 1942.—For jerky motion due to relaxation oscillation to occur, the friction/velocity characteristic of sliding must exhibit a non-linear falling section and a min. A similar type of characteristic belongs to any electrical discharge device with a practically infinite resistance below a definite b.d. potential at which it becomes a conductor. It is suggested that, due to contact electrification, the electrostatic component of the force of sliding friction assumes appreciable proportions when the boundary layer has dielectric properties; thus cycles of slow charging and rapid discharging occur and cause relative motion to proceed by cycles of slow sliding and rapid slipping when the average velocity, determined by the rate of propulsion of one friction element, is smaller than the velocity for which the frictional force assumes the smallest value. Experiments are presented to demonstrate that jerking decreases when the dielectric strength of the lubricating material is diminished, and that, with the same lubricant, jerking decreases as the rate of propulsion is increased. Solid metal cylinders of 5·33 cm. nominal dia. were forced through hollow steel cylinders of slightly smaller bore, with various lubricants, in a testing machine which was operated slowly and at a uniform rate. The electric discharge current which accompanied jerking, even when both friction elements were made of steel, was observed when the friction elements were insulated from the machine and connected to a ballistic galvanometer. In accordance with the electrostatic interpretation of jerky motion due to relaxation oscillation, the surfaces remained undamaged and Amontons' law was obeyed when heavy jerking took place, whereas the relative motion of the two friction elements proceeded smoothly when the surfaces became severely torn, and the tangential force increased at a rate more than proportional to the radial force.

555 539.63

The contact of colliding surfaces. BOWDEN, F. P., AND TABOR, D. *Engineer, Lond.*, 172, *pp.* 380–382, *Nov.* 28, 1941.

556 539.893

Explorations toward the limit of utilizable pressures. BRIDGMAN, P. W. *J. Appl. Phys.*, 12, *pp.* 461–469, *June*, 1941.

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557 541.113

The heat contents of bivalent sulphates in extremely dilute aqueous solutions. ROBINSON, A. L., AND WALLACE, W. E. *J. Amer. Chem. Soc.*, 63, *pp.* 1582–1584, *June*, 1941.

558 541.115

The free energies of reactions of calcium carbide. WEST, F. B., AND MONTONNA, R. E. *J. Phys. Chem.*, 45, *pp.* 1179–1194, *Nov.*, 1941.—Free energies, heats of reaction and changes in sp. hts. have been estimated for 68 possible reactions of calcium carbide with some 40 reagents. An overwhelming majority of these reactions are thermodynamically possible.

559 541.118 : 541.128 : 665.53

Cracking. KEITH, P. C., NOFSINGER, C. W., HIGHTOWER, J. V., AND DICKINSON, N. L. *Ann. Rev. Petrol. Technol.*, 6, *pp.* 110–139, 1941.—A general survey covering the following aspects: a summary of the extension of catalytic cracking methods in 1940, showing the construction of units to produce high-octane fuels, increased use of crude combination units, the rise in octane number of motor fuels, and the extension of cracking operations as a basis for chemical industries; a brief and necessarily incomplete report of the progress of cracking in various countries; a description of some commercial cracking units, including naphtha hydroformers, Houdry catalytic cracking units, the "fluid" catalyst process, cracking with gas recirculation, combination crude topping and thermal cracking units, coking units, and gas-oil cracking units; an account of cracking research in 1940 with reference to thermal and catalytic cracking, and cracking thermodynamics. N. M. B.

See Abstr. 507 541.123.4 : 536.77 : 539.133

See Abstr. 469 541.123.4 : 539.133 : 536.75

560 541.124

Surface conditions of precipitates and rate of reaction. IV. Reduction of mercurous chloride by hydroxylamine. JAMES, T. H. *Commun. No.* 792

Kodak Res. Lab. *J. Amer. Chem. Soc.*, 63, *pp.* 1601–1605, *June*, 1941.—The molecular type structure and very low electrical conductivity of Hg_2Cl_2 appear to preclude the passage through the crystal of interstitial ions. Reduction of Hg_2Cl_2 by hydroxylamine is quite similar, formally, to the reduction of AgCl by this developing agent. A study was made of the effect of the (1) age of the precipitate, (2) adsorbed dyes and gelatin, (3) variation of the hydroxylamine concentration, and (4) variation in concentration of the excess chloride ion upon the rate of reduction of precipitated Hg_2Cl_2.

561 541.124

Coulombic energy of activation. AMIS, E. S. *J. Amer. Chem. Soc.*, 63, *pp.* 1606–1609, *June*, 1941.—The change of energy of activation between reactants of different ionic type in various solvents, when the reaction rates are measured in different iso-dielectric media, is a change in the coulombic energies of the ions down almost to a dielectric const. of 40. At 40 and below, the calculated changes of coulombic energies are progressively greater than the observed changes in energies of activation as the dielectric const. is continually lowered.

562 541.124

Reduction equilibria of zinc oxide and carbon monoxide. TRUESDALE, E. C., AND WARING, R. K. *J. Amer. Chem. Soc.*, 63, *pp.* 1610–1621, *June*, 1941.

563 541.124

The rate of oxidation of sulphite ions by oxygen. FULLER, E. C., AND CRIST, R. H. *J. Amer. Chem. Soc.*, 63, *pp.* 1644–1650, *June*, 1941.—The reaction of sodium sulphite solutions saturated with oxygen at 1 atm. has been found to be strictly first order with respect to sulphite ion concentration. The sp. reaction rate is $0{\cdot}013$ sec.$^{-1}$ at 25°. The rate is directly dependent upon the cupric ion concentration when this exceeds 10^{-9} *M* and the catalytic constant is $2{\cdot}5 \times 10^6$ l. mole^{-1} sec.$^{-1}$ at 25°. The mechanism of the oxidation is discussed in terms of the characteristics of chain reactions. The rôles of positive catalysts in the primary process and of inhibitors in the chain-breaking process have been interpreted in the light of the data available.

564 541.124

Monocyclic reactions with three centres. HAY, G. E., AND MCDONALD, H. J. *J. Phys. Chem.*, 45, *pp.* 1177–1178, *Nov.*, 1941.

565 541.124

Reaction rates of the oxidation of liquid acetaldehyde. HEATLEY, A. H. *Canad. J. Res. B*, 19, *pp.* 261–274, *Nov.*, 1941.—In the commercial process for producing acetic anhydride and acid by the oxidation of acetaldehyde the observed concentrations of anhydride could not be accounted for till allowance was made for an important side reaction. The paper gives the differential equations based on the suggested mechanism; their solution is shown for certain limiting values of the reaction velocity coefficients, but in the general case numerical methods are required. Calculated and observed values are compared. Continuous operation of the process is also studied briefly.

566 541.124

Mechanism and chemical kinetics of organic reactions in liquid systems. *Trans. Faraday Soc.*, 37, *pp.* 601–804, *Dec.*, 1941.—A general discussion of the following papers submitted: Introductory remarks, Ingold, C. K.; Mechanism and kinetics of substitution at a saturated carbon atom, Hughes, E. D.; Mechanism and kinetics of aromatic sidechain substitution. Interpretation of reaction data by the method of relative energy levels, Baker, J. W.; Activation energy of ionic substitution, Baughan, E. C., and Polanyi, M.; The mechanism and kinetics of elimination reactions, Hughes, E. D., and Ingold, C. K.; Mechanism and kinetics of carboxylic ester hydrolysis and carboxyl esterification, Day, J. N. E., and Ingold, C. K; Mechanism of the addition and condensation reactions of carbonyl compounds, Watson, H. B.; Some observations relating to the prototropic changes of carbonyl compounds, Watson, H. B.; Mechanism and kinetics of anionotropic change, Balfe, M. P., and Kenyon, J.; Kinetics and mechanism of some electrophilic benzene substitution reactions, Bradfield, A. E., and Jones, B.; Mechanism and kinetics of additions to olefinic compounds, Williams, G.; The mechanism of the Friedel–Crafts reaction, Fairbrother, F.; The mechanism and kinetics of reactions involving free radicals, Waters, W. A.; Mechanism of the Cannizzaro reaction and some allied processes, Weiss, J.; The mechanism and kinetics of ring-closure, Bennett, G. M.

567 541.126

The unsensitized slow combination of hydrogen and oxygen between the second and third explosion limits in the temperature range 500°–560°C. DAINTON, F. S. *J. Chem. Phys.*, 9, *pp.* 826–827, *Nov.*, 1941.

See Abstr. 453 541.127 : 536.242

568 541.127 : 536.49 = 3

Kinetics of the thermic decomposition of $CaCO_3$. KAPPEL, H., AND HÜTTIG, G. F. *Kolloid Z.*, 91, *pp.* 117–134, *May*, 1940.—The decomposition of $CaCO_3$ was investigated in the temperature range between 600° and 700°C., and the relation between reaction time and CO_2 content in different layers of a solid body of $CaCO_3$ powder was determined. In the deeper layers reaction time is $\propto$ difference in CO_2 content at the beginning and at the end of the reaction, for the surface layers the time is $\propto$ the log of this difference. In the latter case the reaction velocity is mainly determined by the chemical process of decomposition, in the former case by the heat conveyed to

the body during unit of time. For very deep layers diffusion and heat conductivity may play a part. R. N.

569 541.128 = 3

Influence of carrier structure and method of preparation on Pt catalysers. SCHOON, T., AND BEGER, E. *Z. phys. Chem. A*, 189, *pp.* 171–182, *Aug.*, 1941.—The relations between properties and morphology of catalysers are investigated. Hydration is favourably affected by a fine crystalline structure while the prevalence of conglomerates leads to dehydration. The size and formation of the crystallites is mainly dependent on the structure of the carrier. The experiments were carried out with Pt on asbestos, A_2O_3–Pt contacts, carbon–Pt contacts and silica-gel contacts with Pt or CuO. Hydration and dehydration curves were obtained and ultramicroscopic pictures were taken. R. N.

570 541.128

Vanadium pentoxide as a catalyst for sodium chlorate in weed destruction. BATES, G. H. *Nature, Lond.*, 148, *p.* 753, *Dec*, 20, 1941.

571 541.128 : 541.183

Physico-chemical investigations on catalytic mechanism. II. Note on the Fischer–Tropsch synthesis of hydrocarbons with special reference to its reaction mechanism. HAMAI, S. *Bull. Chem. Soc. Japan*, 16, *pp.* 213–228, *July*, 1941.—Introductory remarks concern the various mechanisms proposed for the Fischer–Tropsch reaction (conversion of mixtures of CO and H_2 by various catalysts to hydrocarbons) and a new interpretation is now presented and discussed in detail. The rôle of CH_2 in hydrocarbon chemistry in general is stressed and especially for this particular synthesis, and approx. values of the activation energies for the various reactions involved in the synthesis are presented and considered in correlation with adsorption. The nature of the polymerization process is examined and the question of surface migration is correlated with the polymerization reaction. Adsorption and catalytic activity are also reviewed in the light of desorption experiments. Various pretreatment effects on the catalytic activity are finally discussed. H. H. HO.

See Abstr. 559 541.128 : 665.53 : 541.118

572 541.132 = 3

Some potentiometric measurements for determining the complex ions in cadmium salt solutions. LEDEN, I. *Z. phys. Chem. A*, 188, *pp.* 160–181, *April*, 1941.—The complex ions of Cd salts containing Cl, Br, J, SCN, NO_3 or SO_4 are determined by measuring the e.m.f. of chains formed by the Na salts of these substances in addition to $NaClO_4$, $HClO_4$, $Cd(ClO_4)_2$ and quinhydrone, and using Au and Cd amalgam as electrodes. The complexes are calculated by means of the law of mass action and graphs are given showing the ion concentrations as functions of the anion concentrations. The stability constants for the dissociation of the complexes are calculated and compared with those found by previous investigators. R. N.

573 541.133 : 537.226.2 = 4

Conductivity and dielectric constant of a potassium chloride solution of normal conc. in u.h.f. fields. DIVILKOVSKY, M., AND MASCH, D. *J. Phys., U.S.S.R.*, 4, 1–2, *pp.* 59–65, 1941.—The thermometric method was used. For a field of λ443 cm. the conductivity is 5% less than it is at l.f., and for a field of λ23·6 cm. it is 30% less. The dielectric constant is 100 for λ23·6 cm. A. J. M.

574 541.134

The ionization constant of HCO_3^- from 0 to 50°. HARNED, H. S., AND SCHOLES, JR., S. R. *J. Amer. Chem. Soc.*, 63, *pp.* 1706–1709, *June*, 1941.—By means of an enclosed gas electrode system the ionization constant of HCO_3^- was determined at 5 deg. intervals from 0° to 50°. Equations are derived from these results by means of which the standard heat content, heat capacity and entropy, of the ionization reaction may be computed.

575 541.134

The elimination of liquid-junction potentials. III. Comparison of the Ag/AgCl and Ag/AgBr electrodes at 25°. OWEN, B. B., AND KING, E. J. *J. Amer. Chem. Soc.*, 63, *pp.* 1711–1712, *June*, 1941.—The standard potentials of the Ag/AgBr and Ag/AgCl electrodes were compared in cells with liquid junctions at 25°. The difference was found to be 0·15100 V, in good agreement with the corresponding values 0·15108 and 0·15105 obtained from cells without liquid junctions. [See Abstr. 4664 (1938)].

576 541.134

The effect of electrostatic forces on electrokinetic potentials. EVERSOLE, W. G., AND BOARDMAN, W. W. *J. Chem. Phys.*, 9, *pp.* 798–801, *Nov.*, 1941.—Assuming that the ions in solution near a charged wall are subjected only to electrostatic and kinetic forces, it is shown that the potential gradient normal to the wall is determined principally by the valence and concentration of the ion of opposite charge to the wall. Assuming that the valence and concentration of this ion determine the effect of the salt on the electrokinetic potential of the wall, the surface potential of the wall and the thickness of the immobilized liquid layer are calculated from electrokinetic-potential data. Salts of normal ions cause relatively small changes in the surface potential and thickness of the immobilized layer at a glass surface and these changes occur only at very low salt concentrations. Salts containing abnormal ions produce larger changes and the change continues over a much wider concentration range. The extreme effectiveness of salts like $AlCl_3$ and $ThCl_4$ in lowering negative electrokinetic potentials cannot be accounted for by the higher valence of the ions.

577 541.134

A modified theory of the electrical double layer. WHITNEY, R. B., AND GRAHAME, D. C. *J. Chem. Phys.*, 9, *pp.* 827–828, *Nov.*, 1941.

578 541.141.1 = 3

Photochemical chlorination and chlorine-sensitized oxidation of pentachloroethane. SCHUMACHER, H.-J., AND THÜRAUF, W. *Z. phys. Chem. A*, 189, *pp.* 183–199, *Aug.*, 1941.—Pentachloro-ethane in the presence of Cl_2 and of Cl_2 and O_2 was subjected to irradiation with a slightly converging beam of a wavelength of 4 358 Å furnished by a Hg lamp. The quantum yield for the chlorination at 90°C. was about 400 mol./*hv* at pressures of 190 mm. of Cl_2 and 35 mm. of C_2HCl_5 and with an absorption of $1{\cdot}3\times10^{12}$ *hv*/cm.^{3} sec. In the presence of O_2 the quantum yield was 350 mol./*hv* under similar conditions and at pressures of 40 mm. C_2HCl_4, and 100 mm. O_2, and 100 mm. Cl_2. The final products are about 80% CCl_3COCl and about 20% phosgene. The mechanism of the chain reactions is discussed and the laws of the reaction velocities are stated. R. N.

579 541.141.12

The effect of ultra-violet light on methyl cellulose in solution. SPITZE, L., MOORADIAN, A., HARTIGAN, R. H., AND HANSEN, L. A. *J. Amer. Chem. Soc.*, 63, *pp.* 1576–1580, *June*, 1941.—Using a quartz capillary mercury arc lamp to furnish ultra-violet light, an out-gassed sample of methylcellulose in water was irradiated in a stoppered quartz flask. Viscosity, osmotic-pressure, and copper-number data show that the methyl cellulose molecule is degraded.

580 541.143

The reversible bleaching of chlorophyll. LIVINGSTON, R. *J. Phys. Chem.*, 45, *pp.* 1312–1320, *Nov.*, 1941.—Air-free chlorophyll solutions are reversibly bleached by light. This reversible bleaching is inhibited by oxygen. The quantum yield of the photochemical bleaching is not unity, as previously suggested, but is approx. 5×10^{-4}. The regeneration of the bleached chlorophyll follows a second-order law. The smallest rate constant which was observed for this regeneration reaction was 7×10^5 li./mole/sec. Allylthiourea and similar easily oxidizable reducing agents have, at moderately low concentrations, little or no effect upon the bleaching. These several results are compared with a general theory of dye photochemistry [Abstr. 777 (1941)].

See Abstr. 445 541.144.7 : 535.371

581 541.145

The photolysis of simple alkyl esters. ROYAL, J. K., AND ROLLEFSON, G. K. *J. Amer. Chem. Soc.*, 63, *pp.* 1521–1525, *June*, 1941.—The photolysis of methyl formate and methyl acetate was investigated by means of the mirror method. Free radicals were formed by the esters. No H atoms were detected. The rates of removal of Bi mirrors by fragments formed in the decomposition of methyl formate and methyl acetate were compared with those obtained from acetone. The photolysis of methyl formate in a static system was studied. Mechanisms for some of the net reactions are suggested.

582 541.145

Mercury photosensitized reactions involving benzene and hydrogen. FORBES, G. S., AND CLINE, J. E. *J. Amer. Chem. Soc.*, 63, *pp.* 1713–1716, *June*, 1941.—Benzene vapour is decomposed by mercury vapour excited by resonance radiation of wavelength 1 849 Å, or by unsensitized radiation of wavelength $< 2\,000$ Å. Phenol vapour is decomposed by mercury vapour excited by resonance radiation of wavelength 2 537 Å. A more rapid reaction occurs after hydrogen is introduced. Mixtures of benzene vapour and hydrogen, both at 75 mm., and saturated with mercury vapour at 55°, were exposed to resonance radiation, mostly of wavelength 2 537 Å, in a circulating-flow system which condensed out the earlier reaction products as liquids without opportunity for further irradiation. A relatively volatile reaction product appeared to be a cyclohexadiene. The less volatile reaction products contained hydrogen and carbon in the ratio of 0·107.

583 541.145

The photochemical decomposition of rotenone. TS'AI LIU-SHENG, AND KE T'ING-SUI. *J. Amer. Chem. Soc.*, 63, *pp.* 1717–1718, *June*, 1941.—Study of the absorption spectra of solutions of rotenone in ethyl alcohol, saturated with CO_2 and with O_2, exposed and unexposed to sunlight, showed that O_2 does not decompose rotenone in the dark. In light, however, there is marked decomposition.

584 541.147 : 77

Note on the evaluation of photographic speed from sensitometric data. TUTTLE, C. *Commun. No.* 818 *Kodak Res. Lab. J. Opt. Soc. Amer.*, 31, *pp.* 709–712, *Nov.*, 1941.—A method of ascertaining the gradient speed of a photographic material without the use of special gradient-measuring instruments is pointed out. The derived formula shows the relation which must exist between density and log exposure at the value of exposure which is the reciprocal of the speed.

585 541.18.041

The precipitation of silver chromate. III. Gelatin medium. HOOK, A. VAN. *J. Phys. Chem.*, 45, *pp.* 1194–1203, *Nov.*, 1941.—[See Abstr. 914 (1941)]. When silver chromate precipitates in the presence of gelatin, the kinetics of the reaction are very similar to the same process occurring in water. The course of precipitation is described by

$$-\frac{dS}{dt} = \frac{k_1}{k_3}S + k_2nS^2$$

The solution of this equation is not practical in form, and it must be either approximated or handled as a

2-step process:—a monomolecular seed generation defined by

$$-\frac{dS_1}{dt} = k_1 S$$

followed by a bimolecular growth of these seeds, defined by

$$-\frac{dS_2}{dt} = k_2 n S^2$$

The reaction rate constants observed in gelatin medium are within 0·1 of the observed values in water medium, suggesting an identical mechanism for both cases.

586 541.18.041

Reversible aggregations of colloidal particles. I. Centrifugal experiments on thixotropic iron oxide sols. HELLER, W. *J. Phys. Chem.*, 45, *pp.* 1203–1227, *Nov.*, 1941.—When a thixotropic sol is centrifuged, it separates into an upper dilute sol phase and a lower concentrated phase, which is found to be a thixotropic gel. The kinetics of this separation and the influence of ageing, of electrolyte concentration, of various organic substances, and of weak mechanical vibrations upon it, are studied. The experiments show that reversible aggregates (which can be destroyed by gentle shaking) develop in thixotropic sols. Their subsequent association to a gel structure leads to the transformation of the sols into gels. Centrifugation brings about settling of these reversible aggregates and their premature association. Besides the reversible aggregates, called "geloids" because they represent tiny elementary gels, irreversible ones are present in thixotropic systems in minor quantity. These settle swiftly in a centrifugal field, whereas the settling of the reversible aggregates is a slow process. In freshly shaken systems settling of the irreversible aggregates starts immediately after centrifugation sets in, whereas geloids start settling considerably later, when they have again grown to a size where settling becomes possible.

587 541.18.05

Contributions to the chemistry of indium. IV. The effects of certain polyhydroxy non-electrolytes upon the precipitation of hydrous indium hydroxide. MOELLER, T. *J. Chem. Phys.*, 45, *pp.* 1235–1241, *Nov.*, 1941.—Indium sulphate solutions treated with extremely large amounts of levulose, *d*-glucose, or sucrose, yield no precipitate when made alkaline but contain negatively charged particles of colloidal indium hydroxide. With lesser concentrations of these sugars precipitates are produced which are in part peptized by the excess hydroxyl ion to negatively charged opalescent sols. Glycerol exerts no observable effect upon the precipitation of hydrous indium hydroxide. Electrometric titrations in the presence of these polyhydroxy non-electrolytes give no evidence of complex formation and point only to adsorption of hydroxyl ion by the precipitated indium hydroxide with consequent formation of a negative sol. Determination of the filterable indium hydroxide produced in the presence of these compounds shows the order of decreasing effectiveness in inhibition of precipitation to be levulose > *d*-glucose > sucrose > glycerol, glycerol having no effect.

588 541.182 : 531.51

The sedimentation of washed red blood-cells. WHITTINGTON, R. B. *Phil. Mag.*, 33, *pp.* 68–76, *Jan.*, 1942.—The experiments to be described were made as a first step towards a mechanical investigation of the red-cell sedimentation test. The sedimentation of whole-blood suspensions presents a complex mechanical picture which may be simplified by suspending the washed red-cells in an isotonic saline solution. The cylindrical strings of cells known as rouleaux do not form when the plasma has been washed away; and we are left with discrete cells of known mean size and density falling through a liquid of known viscosity and specific gravity.

589 541.182 : 532.71 = 3

Measurement of the dialysis of soap in aqueous solution. LAMM, O. *Kolloid Z.*, 91, *pp.* 275–279, *June*, 1940.—The dialysis of Na-laureate and K-acetate in aqueous solution was measured in small concentrations at room temperature, the influence of hydrolysis being eliminated. The process is normal at the beginning, but after some time an anomalous hindrance was observed, ascribed to the growing formation of micelles outside the diaphragm. [See Abstr. 597 (1942)]. R. N.

590 541.182.04 = 3

Sediment volumes of polydisperse kaolin powders in electrolyte solutions. II. KANDILAROW, G. G. *Kolloid Z.*, 91, *pp.* 56–61, *April*, 1940.—[See Abstr. 2544 (1940)]. The sediment volumes of kaolin powder in Na salt solutions of varying concentrations are investigated, particularly the influence of the anion valencies. The greatest changes were found with HCl and NaOH solutions. They are explained by the action of the H and OH ions. R. N.

591 541.182.054

Metallic particles dispersed in organic liquids by evaporation. TORIKAI, R., AND YAMAGUTI, Z. *Electrotechn. J.*, 5, *pp.* 63–66, *April*, 1941.—Ag and Cd were dispersed in about 300 $cm.^3$ of liquid paraffin or dibutyl phthalate by revolving a glass cylinder 10 cm. dia. and 7 cm. long, at 1 200 r.p.m. within a heated crucible, which, in the case of Ag, had an evaporation surface of 44 $mm.^2$ When Ag was heated at 930°C. a dispersed system of 0·1 mg./$cm.^3$ concentration and 0·1 μ particle dia. was obtained in 3–5 hr., and at 1 000°C. the particle dia. was 0·35 μ; to obtain a dispersed system of particles of 0·01 μ diameter a great deal of mechanical contrivance was

necessary. When Cd was treated as above, only a very small portion dispersed, but when a crucible of 68 mm.^{2} evaporation area was used and Cd heated at 260°–290°C., particles of 0·1–0·15 μ, and at 330°–340°C. particles of 0·2–0·25 μ dia., were dispersed. When a d.c. voltage was impressed on each of the above dispersed systems, the particles moved irregularly, but with an a.c. voltage only those in dibutyl phthalate moved. Furthermore, Bi and Cu could be dispersed in liquid paraffin like Ag. H. H. HO.

592 541.182.4

Emulsion type. HILDEBRAND, J. H. *J. Phys. Chem.*, 45, *pp.* 1303–1305, *Nov.*, 1941.—The various factors which contribute to the stability of one type of emulsion rather than the inverse type are supplemental rather than rival. The direction of film curvature for min. energy has probably been overemphasized at the expense of the more mechanical forces operating during the emulsification process. The rupture of a film separating two droplets can be resisted by a larger rise in interfacial tension at the threatened point if the reserve emulsifying agent is dissolved in the liquid forming the film, i.e. the external phase, owing to the lower rate of adsorption in that case.

593 541.182.4 : 532 = 3

State of solution and swelling behaviour of casein in milk. KÜNTZEL, A., AND DOEHNER, K. *Kolloid Beih.*, 51, *pp.* 277–358, *June*, 1940.—The physicochemical characteristics of casein are investigated with regard to its growing importance as a basic material for synthetic textiles and other industrial uses. Number, size and shape, of the casein particles in milk are determined by ultramicroscopic counting, by viscosity measurements and by spectrometric investigation of the Tyndall effect. The results of the latter, and the fact that no double refraction was observed during flow, lead to the conclusion that spherical particles are concerned. The cataphoretic velocity of migration was measured in order to determine the ζ-potential. The influence of alkalis and acids on the "charge swelling," and of carbamide and formaldehyde on the swelling behaviour, are investigated by chemical, viscosimetric, osmometric and optical methods. A bibliography of 74 publications is given. R. N.

594 541.182.5

Studies on silicic acid gels. XIII. Some examples of re-gelation. HURD, C. B., AND THOMPSON, JR., L. W. *J. Phys. Chem.*, 45, *pp.* 1263–1267, *Nov.*, 1941.—Silicic acid gels (containing 3·5% of silica) after setting were beaten into fine particles in an equal volume of distilled water. The settled material showed a type of re-gelation. These gels did not show true thixotropy. The condensations which apparently cause the setting of the original gel mixture proceed only to a limited extent in these sedimented residues.

595 541.182.5

The solvation of gelatin. HEYMANN, E. *J. Phys. Chem.*, 45, *pp.* 1143–1151, *Nov.*, 1941.—The hydration of gelatin has been determined from the min. amount of water present in the gelatin which causes the volume contraction on swelling in water to be reduced to zero. It is thus defined as that part of the water in the gel which has a higher density than free water. The results of various methods for the determination of hydration are discussed. The discrepancies cannot be explained on the basis of the varying activity of the water in the systems concerned. The volume change during the sol–gel transformation of gelatin in an alcohol–water mixture has been measured. A decrease in the volume is observed, as in purely aqueous solutions. The complete isotherm of the apparent adsorption on gelatin in alcohol–water mixtures has been investigated at 0° and at 22°C. The solvation layer contains some alcohol besides water, the ratio alcohol/water increasing with increasing temperature. The bearing of this result in other directions is discussed.

596 541.182.5

Influence of temperature on gel formation. MCDOWELL, R. *Nature, Lond.*, 148, *pp.* 780–781, *Dec.* 27, 1941.

See Abstr. 386 541.182.6 : 532.13

597 541.182.6 : 532.72 = 3

Refractometric investigation of free diffusion of soaps in aqueous solution. LAMM, O., AND HÖGBERG, H. *Kolloid Z.*, 91, *pp.* 10–19, *April*, 1940.—The free diffusion of soaps in diluted aqueous solutions was investigated by a method allowing of determining the conc. coeff. over the total height of the diffusion region, assuming the conc. $\propto$ increment of refr. index. While in the ideal case the graph of conc. gradient *v.* height resembles a Gauss error curve, there are anomalies in certain ranges of concentration. Measurements, made on Na salts of lauric, caprinic and caprylic acids, show that these anomalies correspond to a more or less rapid change of the diffusion const. with concentration. The transformation interval is shifted towards lower values of concentration with increasing length of the C-chain. R. N.

598 541.182.63 : 532.1 = 3

On the influence of strong electrolytes on the viscosity of quartz suspensions. BUZÁGH, A. VON, AND ERÉNYI, E. *Kolloid Z.*, 91, *pp.* 279–287, *June*, 1940.—The viscosity of homodisperse quartz suspensions of different degrees of dispersity and different concentrations in aqueous and electrolyte solutions was measured at 25°C. by means of Ostwald's viscosimeter, the results being expressed in an empirical equation. The viscosity decreases with increasing

particle size. Increasing viscosity with increasing degree of dispersity is attributed to the interaction of lyospheres and to the electrolytic effect for aqueous suspensions, and to the aggregation due to adhesive forces for electrolytic suspensions. For neutral salts the valency rule and the rule of lyotropic series are valid. Salts which change their charge produce a max. value of viscosity at the iso-electric points. Mineral acids are more effective than neutral salts. Alkali hydroxides have no influence on viscosity at medium concentrations [see Abstr. 529 (1942)]. Viscosity plotted against the activity coefficient gives an S-shaped curve. R. N.

See Abstr. 395 541.183 : 532.62

See Abstr. 571 541.183 : 541.128

599 541.183.022

Surface films of lupane derivatives. BILHAM, P., JONES, E. R. H., AND MEAKINS, R. J. *J. Chem. Soc.*, *pp.* 761–766, *Nov.*, 1941.

600 541.183.1 = 3

Electrolyte adsorption and activity coefficient. IV. BROESE, S. *Kolloid Z.*, 91, *pp.* 20–32, *April*, 1940.—The linear relationship established for the adsorption of strong acids by carbons [Abstr. 4235 (1939)] holds for medium conc. but is inadequate for very low and very high conc. [Abstr. 2746 (1939)]. In the latter case the valency relations led to discrepancies and the present investigations, which give some further proofs for the linearity in medium-conc. ranges, also explain these discrepancies. The part played by the ash contents in the carbons is investigated. In comparing the curves for mono- and dibasic acids the single cation activity coefficient must be used for the dibasic acid. Thus the curves valid for mono- and dibasic electrolytes are brought to coincidence for carbons free of ashes.

R. N.

601 541.183.1

Synthetic resins as exchange adsorbents. MYERS, R. J., EASTES, J. W., AND MYERS, F. J. *Industr. Engng Chem.*, 33, *pp.* 697–706, *June*, 1941.—The recent development of synthetic resins which exhibit exchange-adsorbent properties has opened new fields of application and promises unique uses in the purification of water and other fluids, in the recovery of valuable substances, in the removal of undesirable impurities, etc. The resinous ion exchangers offer the advantages of high exchange capacity, high exchange velocity, excellent stability (both mechanical and chemical), to acids, alkali, and heat, uniformity of quality, low operating costs, freedom from leakage, and wider fields of application. Laboratory and field tests have proved the practicability of the use of resinous exchangers in the softening of water, the partial or complete removal of salts from water, sugar solutions, and protein solutions, in the recovery of traces of copper and other valuable metals, in the removal of iron and acids from industrial effluents and commercial products.

602 541.183.1 : 621.187.12

Adsorption of soluble silica from water. BETZ, L. D., NOLL, C. A., AND MAGUIRE, J. J. *Industr. Engng Chem.*, 33, *pp.* 814–820, *June*, 1941.—[Abstr. 221 B (1942)].

See Abstr. 351 541.183.2 : 519.1

See Abstr. 391 541.183.2 : 532.61

603 541.183.2 : 621.187.12

Adsorption process for removal of soluble silica from water. BETZ, L. D., NOLL, C. A., AND MAGUIRE, J. J. *Trans. Amer. Soc. Mech. Engrs*, 63, *pp.* 713–720, *Nov.*, 1941.—[Abstr. 222 B (1942)].

604 541.183.25

Use of small glass spheres in adsorption from non-aqueous media. I. Adsorption of iodine from carbon tetrachloride. URBANIC, A. J., AND DAMERELL, V. R. *J. Phys. Chem.*, 45, *pp.* 1245–1251, *Nov.*, 1941.—Glass spheres have been prepared by passing powdered glass through a flame into CCl_4. The diameter of these spheres was limited by fractional sedimentation to 40–80 μ; 92% of the resulting particles were spheres. The area of these particles was determined microscopically to be 2 870 cm.^{2}/6·901 g. of spheres. The adsorption of I from a CCl_4 solution on this surface was measured. Assuming the adsorbed I layer to be monomolecular, and the molecule to be spherical and to have an atomic domain radius of $1{\cdot}97 \times 10^{-8}$ cm., it is calculated that 39·2% of the surface was covered.

605 541.183.3

Application of the Gibbs adsorption equation to solutions of paraffin-chain salts. ALEXANDER, A. E. *Nature, Lond.*, 148, *p.* 752, *Dec.* 20, 1941.

606 541.183.59

Adsorption at crystal-solution interfaces. XII. A study of the adsorption of isomeric dyes by crystals of cupric acetate during their growth from solution. FRANCE, W. G., AND WOLFE, K. M. *J. Amer. Chem. Soc.*, 68, *pp.* 1505–1507, *June*, 1941.

607 541.183.59 : 548.5 = 3

Novel radioactive processes for determination of ionic adsorption at crystalline surfaces. II. IMRE, L. *Kolloid Z.*, 91, *pp.* 32–39, *April*, 1940.—As shown previously [Abstr. 2365 (1939)], the constants of the adsorption isotherm for self-adsorbing systems may be readily computed under the assumption that Langmuir's isotherm equation holds true. A quantitative determination is given for the formation of active spots on crystalline surfaces. The increase of their number with increasing adsorption energy is shown experimentally for the adsorption of $Pb(NO_3)_2$ on $PbSO_4$ or $PbCrO_4$, of $AgNO_3$ on AgCl and of $BaCl_2$ on $BaSO_4$. The phase volume of true adsorption may be determined by the radioactive indicator

method. From the speed with which the indicator travels into the crystal the number of active spots is computed and thus the isotherm of permutoidal adsorption may be found. R. N.

608 541.23

The atomic weight of fluorine calculated from density and X-ray data. HUTCHISON, C. A., AND JOHNSTON, H. L. *J. Amer. Chem. Soc.*, 63, *pp.* 1580–1582, *Nov.*, 1941.

609 541.24 = 3

The determination of molecular and ionic weights of dissolved substances by dialysis and free diffusion. JANDER, G., AND SPANDAU, H. *Z. phys. Chem. A*, 188, *pp.* 65–89, *March*, 1941.—This is a further polemic article against the method advocated by Brintzinger [Abstr. 2219 (1941)] for measuring the mol. wt. and ionic wt. by dialysis. Special exception is taken to the materials used as diaphragm. The authors show that their own experimental results and those of other investigators prove their criticisms to be well founded. R. N.

610 541.25

Molecular volume of saturated hydrocarbons. KURTZ, JR., S. S., AND LIPKIN, M. R. *Industr. Engng Chem.*, 33, *pp.* 779–786, *June*, 1941.—The molecular volume of saturated hydrocarbons can be calculated with considerable accuracy, using the equation: $V = 16{\cdot}28n_1 + 13{\cdot}15n_2 + 9{\cdot}7n_3 + 31{\cdot}2$. This equation is used to calculate graphs of density *v.* mol. wt. for paraffins and various classes of naphthenes. A means of calculating the degree of cyclization in hydrocyclorubber and related compounds is also proposed.

611 541.25

Partial molal volumes of potassium salts of the Hofmeister series. HALASEY, M. E. *J. Phys. Chem.*, 45, *pp.* 1252–1263, *Nov.*, 1941.—Equations of apparent and partial molal volumes are presented for 5 potassium salts at 10 concentrations (0·005–0·5 molal) and at 11 temperature intervals (between 5° and 30°C.). Like equations are formulated for 3 other potassium salts at a few temperatures only. All the numerical values for KNO_3 are tabulated. The 8 potassium salts are arranged in series according to the magnitude of their change in volume with change in concentration of the solution.

612 541.452

The acid nature of cellulose. I. Equilibria between cellulose and salts. II. The strength of the cellulosic acid. HEYMANN, E., AND RABINOV, G. *J. Phys. Chem.*, 45, *pp.* 1152–1176, *Nov.*, 1941.—The equilibria between purified cotton wool and a number of salts were investigated at various concentrations. Cation-free cellulose liberates acid from salt solutions. The amount liberated depends mainly on the strength of the acid radical and increases with decreasing strength of the acid radical. However, the cation of the salt is not without influence. Similar results were obtained with cellulose prepared from raw cotton by treatment with boiling caustic alkali with exclusion of air; a very low acid value is obtained by prolonged treatment. An unsuccessful attempt was made to prove the existence of an atmosphere of hydrogen ions around the cellulose fibres by the catalytic action on the inversion of sugar. Cation-free cellulose, on digestion with water at an elevated temperature, hydrolyses off soluble cellulosic acid. Potentiometric titration shows that this acid is somewhat stronger than acetic acid.

613 541.571

Hydrogen bonds involving the C–H link. XIV. Solubility of donor solutes in hydrogen bonding solvents. MARVEL, C. S., HARKEMA, J., AND COPLEY, M. J. *J. Amer. Chem. Soc.*, 63, *p.* 1609, *June*, 1941.

614 541.6 : 539.2 : 621.315.616

Plastics and engineering. CARESS, A. *Trans. N.-E. Cst Instn Engrs Shipb.*, [20 *pp.*], 1941.—A brief account is given of the relationships of the various synthetic resins against a background of the naturally occurring macromolecules, such as rubber and cellulose. It is possible, from the simple crystalline structure of paraffin wax, to derive the main features of the structures of polymeric ethylene, vinyl chloride and acetate, styrene, methyl methacrylate, isobutylene, vinylidene chloride, the synthetic rubbers and the nylon family. Whereas paraffin wax and the linear polymers consist of thread-like molecules held together by weak residual forces or, in nylon, by the somewhat stronger hydrogen bonds, graphite and diamond are familiar examples, outside plastics, of 2- and 3-dimensional molecules, respectively. Phenol-formaldehyde is a very imperfect 3-dimensional molecule compared with diamond, but, in combination with the linear molecules of cellulose fillers, it is the most widely used plastic in many branches of engineering. It is concluded, from a qualitative survey of physical properties in relation to chemical composition and molecular structure and from a short review of the properties and applications of existing plastics, that further progress of plastics as engineering materials is to be expected, particularly by utilizing controlled linkages between molecules and the marked increase of strength resulting from cold drawing.

615 541.634

Molecular configurations in rotational isomerism. MIZUSHIMA, S., MORINO, Y., AND TAKEDA, M. *J. Chem. Phys.*, 9, *p.* 826, *Nov.*, 1941.

616 541.634

The energy of isomerization of *cis-* and *trans-*dichloroethylene. WOOD, R. E., AND STEVENSON, D. P. *J. Amer. Chem. Soc.*, 63, *pp.* 1650–1653, *June*, 1941.

617 541.634

Contribution to the study of *cis-trans* isomers

derived from 3,3-diphenyl-1-hydrindone. Synthesis of 3,3-diphenylhydrindene and some of its derivatives. GAGNON, P. E., AND CHARETTE, L. P. *Canad. J. Res. B*, 19, *pp.* 275–290, *Nov.*, 1941.—*Cis-trans* isomers were obtained by condensation of 3,3-diphenyl-1-hydrindone with benzaldehyde or its *o*- and *m*-methyl-, *o*- and *p*-methoxy-, *o*-ethoxy, *o*- and *p*-chloro-derivatives, and by conversion of the condensation products by treatment with acetic acid. 3,3-diphenyl-1-hydrindone was reduced to 3,3-diphenylhydrindene, and the condensation products of that ketone with the above-mentioned aldehydes to derivatives of 3,3-diphenylhydrindene.

618 541.634

The infra-red bands of hydrogen peroxide at λ9 720 and the structure and torsional oscillation of hydrogen peroxide. ZUMWALT, L. R., AND GIGUÈRE, P. A. *J. Chem. Phys.*, 9, *pp.* 458–462, *June*, 1941.—A high-dispersion study of the OH bands of H_2O_2 in the photographic infra-red is described. The rotational structure of the 2 hybrid bands at 10 283·68 cm.$^{-1}$ and 10 291·08 cm.$^{-1}$ is analysed. The small moment of inertia of H_2O_2 is found to be $2{\cdot}78_6 \times 10^{-40}$ g.cm.^{2} while the harmonic mean of the two larger moments of inertia is found to be approx. $33{\cdot}9 \times 10^{-40}$ g.cm.^{2} The planar *cis*-configuration is ruled out spectroscopically and it is concluded that H_2O_2 exists in a non-planar form. It is tentatively decided that the vibrational levels are doubled and that the double min. potential associated with the internal rotation of the OH groups has a high and a low barrier.

See Abstr. 476 541.634 : 535.338 : 539.133 : 537.226.2

619 541.64

On the polymerization of ethylene and propylene by free alkyl radicals. BEECK, O., AND RUST, F. F. *J. Chem. Phys.*, 9, *pp.* 480–482, *June*, 1941.—Methyl- and ethyl-induced polymerizations of ethylene and propylene were carried out in static as well as in flow experiments. The latter allowed collection of enough reaction products for analysis by low-temperature distillation. Efficiency of polymerization in propylene is much lower than in ethylene, which is explained by the easy formation of allyl radicals. Analyses of the reaction products indicate that the polymer is formed by the successive addition of olefin molecules to radicals, that chain transfer through radical decomposition takes place, and that the chains are terminated by disproportionation or association of 2 radicals.

620 541.64

Researches on the chemical reaction by use of the thermal diffusion apparatus of Clusius and Dickel. I. Thermal polymerization of methane. HIROTA, K. *Bull. Chem. Soc. Japan*, 16, *pp.* 274–278, *Aug.*, 1941.—A method of thermal polymerization of methane proceeding in a thermal diffusion column as used by Clusius and Dickel is discussed. By this method a good yield of condensed hydrocarbons and highly concentrated hydrogen gas is obtained.

See Abstr. 408 541.64 : 534.321.9

621 541.651 = 3

Quantum-mechanical calculations on the theory of organic dyestuffs. FÖRSTER, T. *Z. phys. Chem. B*, 47, *pp.* 245–268, *Oct.*, *and* 48, *pp.* 12–31, *Nov.*, 1940.—The valency theory of quantum mechanics is applied to 2 idealized models, an odd-numbered conjugated chain of methenyl groups with 2 equal auxochromes at the ends, and a similarly constituted chain but branched at its centre and having 3 equal auxochromes at the ends. As with real dyestuff ions, the shift of light absorption to longer waves is obtained with longer chains and stronger auxochromes. Thus the effect of substitutions in dyestuff ions with 3-numbered symmetry is shown. The substitution rule provides a qualitative explanation of the change of the absorption ranges if equal auxochromes are introduced gradually in the 3 branches of the chain, if the substitutions are made at different points, if rings are formed, or if N atoms are introduced. The results of the calculations agree qualitatively with observations made on basic dyestuffs of various classes.

R. N.

622 541.651.22

The relation between the absorption spectra and the chemical constitution of dyes. XVI. The separation of chromophores in unsymmetrical disazo dyes. BRODE, W. R., AND PIPER, J. D. *J. Amer. Chem. Soc.*, 63, *pp.* 1502–1505, *June*, 1941.

623 541.653.4

Molecular rearrangements involving optically active radicals. X. The retention of configuration in the Wolff rearrangement. LANE, J. F., AND WALLIS, E. S. *J. Amer. Chem. Soc.*, 63, *pp.* 1674–1676, *June*, 1941.

624 541.66

Calculation of the boiling points of aromatic hydrocarbons. KINNEY, C. R. *Industr. Engng Chem.*, 33, *pp.* 791–794, *June*, 1941.—The b.p. of aromatic hydrocarbons may be calculated by using the b.p. equation and the characteristic b.p. numbers. B.p. numbers may be used with limitations to determine the structure of unknown hydrocarbons.

See Abstr. 464 541.66 : 536.63

625 541.67

Note on diamagnetic anisotropy and the method of molecular orbitals. BROOKS, H. *J. Chem. Phys.*, 12, *pp.* 463–465, *June*, 1941.—The simple London theory of the diamagnetic anisotropy of organic molecules containing benzene rings is modified to include the effect of a non-orthogonality of 25% between atomic wave functions on adjacent atoms. Except in the case of diphenyl the effect of such a modification is surprisingly small; that is, although the contributions to the anisotropy from individual electronic orbits is

materially changed, the resultant contribution of all the electrons is hardly altered. The significance of this result is discussed.

626 541.8

Solubility of chlorine in water. WHITNEY, R. P., AND VIVIAN, J. E. *Industr. Engng Chem.*, 33, *pp.* 741–744, *June*, 1941.—The solubility of Cl in water was determined experimentally by passing various Cl–N gas mixtures through an equilibrium cell contained in a thermostat. Temperatures of 10°, 15°, 20° and 25°C. were investigated, using partial pressures of Cl from 0·06 to 1·0 atm. Hydrolysis constants were calculated from the solubility data, assuming Henry's law to apply to the unhydrolysed Cl in solution. These hydrolysis constants have $\frac{1}{2}$–$\frac{3}{4}$ the values as reported by Yakovkin. An equation for extrapolating the solubility to partial pressures of Cl in excess of 1 atm. is presented.

627 541.8 : 532.77 = 3

Physical properties of pyrazole, imidazole and 4-methyl-imidazole and their solutions, especially in benzene. HÜCKEL, W., DATOW, J., AND SIMMERSBACH, E. *Z. phys. Chem. A*, 186, *pp.* 129–179, *May*, 1940.—The following measurements were made on these substances and some other 5-cornered ring-compounds of aromatic character, containing N, and their solutions: density, refractive index, surface tension at different temperatures, mol. wt. at different concentrations, dipole moments, solubility, viscosity, heat of solution and dilution. R. N.

628 541.8 : 532.77

Physical properties of sodium, potassium and ammonium lactate solutions. DIETZ, A. A., DEGERING, E. F., AND SCHOPMEYER, H. H. *Industr. Engng Chem.*, 33, *pp.* 1444–1447, *Nov.*, 1941.—The density, index of refraction, viscosity, boiling and freezing points, and surface tension, of sodium, potassium, and ammonium lactate solutions are reported. These properties were determined for concentrations ranging from 1 to 90%.

See Abstr. 473 541.8 : 536.77

PRACTICAL CHEMISTRY.

629 542.231

Columns for liquid-liquid extraction. NEY, JR., W. O., AND LOCHTE, H. L. *Industr. Engng Chem.*, 33, *pp.* 825–827, *June*, 1941.—Data presented show that, for liquid-liquid extraction, columns with a diameter of 21 mm. and packed with small Berl saddles are about $\frac{3}{4}$ as efficient as spinner type columns. Slender small-capacity columns are very efficient when equipped with spinners. Spinner-type columns do not operate efficiently if there is too great a difference in density in the two liquid phases or if they are easily emulsified.

630 542.48 = 3

Fine-fractionating column entirely of glass applying multiple-chamber tubes. KLEIN, K., STAGE, H., AND SCHULTZE, G. R. *Z. phys. Chem. A*, 189, *pp.* 163–170, *Aug.*, 1941.—The plate column described consists entirely of glass, is corrosion-proof, and may be used for the separation of sensitive substances. With a distillation rate of 1 cm.^{3}/1$\frac{1}{2}$ min., 25 plates, a height of 62 cm. and an effectiveness of 10 theoretical plates, the equivalent height is about 6 cm. The efficiency of a plate is 40%. R. N.

631 542.48

Laboratory-size continuous distillation unit. HUFFERD, R. W., AND KRANTZ, H. A. *Industr. Engng Chem.*, 33, *pp.* 1455–1459, *Nov.*, 1941.

632 542.49

The evaporation of molten metals from hot filaments. CALDWELL, W. C. *J. Appl. Phys.*, 12, *pp.* 779–781, *Nov.*, 1941.—The selection of filament material from which another metal can be evaporated successfully depends largely upon the 3 properties of wetting, reaction or alloying, and evaporation. Nine filament materials and 27 evaporated metals have been investigated and the results summarized in a table. A second table lists satisfactory filament materials for the evaporation of 26 metals.

633 542.74

An apparatus for the determination of the solubilities of gases at high temperatures and high pressures. IPATIEFF, V. N., AND MONROE, G. S. *Science*, 94, *pp.* 423–424, *Oct.* 31, 1941.

CRYSTALLOGRAPHY

634 548 : 535.5

Studies on the Raman effect in single crystals of potassium nitrate. NEDUNGADI, T. M. K. *Proc. Indian Acad. Sci. A*, 14, *pp.* 242–256, *Sept.*, 1941.—Study of the Raman spectrum of a single crystal of KNO_3 gives a number of lines recorded for the first time. The most striking observation in a thermal study of the crystal is that these new lattice lines practically disappear at a temperature (120°C.) just below the transition temperature (129°C.) at which the crystal changes over from orthorhombic to trigonal symmetry. The other lattice lines broaden and shift to lower frequencies with increase of temperature, while the frequency shifts due to the internal oscillations remain appreciably unaltered up to 290°C. A study of the spectrum of the melt shows that there is no conspicuous change in the frequency shifts due to the internal oscillations arising from a change of state. A study of the effect of orientation of the crystal relative to the directions of incidence and observation, and different states of polarization of the incident and scattered radiations, show that the behaviour of the Raman lines in this crystal satisfies the selection rules for the orthorhombic symmetry. A. H.

635 548 : 535.5

Effect of crystal orientation on the Raman spectrum of barytes. BALAKRISHNAN, T. A. S. *Proc. Indian Acad. Sci. A*, 14, *pp.* 257–264, *Sept.*, 1941.—The Raman spectrum of single crystals of barytes has been studied for different orientations. It is found that the frequency ν_2 of the sulphate ion splits into 2 lines, the ν_3 frequency occurs as 4 lines, the ν_1 frequency—which is the symmetric oscillation of the ion—remains single. The ν_4 frequency splits into 8 components. None of the 3 orientations of the crystal gives the complete Raman spectrum, some of the components vanishing in particular orientations, while the intensities of the others vary. The apparent disagreements in the results of previous workers are thus explained. These changes have been observed using only incident unpolarized light, but the Raman spectrum is also examined with light polarized in and perpendicular to the plane of observation. A. H.

636 548 : 537.228.1

Investigation of oscillations of quartz plates by the interference method. KOTLIAREWSKY, M. L., AND PUMPER, E. J. *J. Phys., U.S.S.R.*, 4, 1–2, *pp.* 67–78, 1941.—Using a method similar to that of Dye, a study was made of the oscillations of a number of quartz plates. The frequency spectrum of such plates is found to be completely determined by the crystal structure and by the boundary conditions of the plates. Symmetry of the configuration of the oscillations of plates cut perpendicular to the electric axis serves to indicate the degree of homogeneity. Lack of homogeneity introduces more or less asymmetry into the oscillations and also affects the frequency spectrum. In general it is found that the oscillations of opposite faces of a quartz plate are antisymmetrical, those of the lower surface being the image of those of the upper. A. W.

637 548 : 539.3

On the stability of crystal lattices. VII. Long-wave and short-wave stability for the face-centred cubic lattice. POWER, S. C. *Proc. Camb. Phil. Soc.*, 38, *pp.* 61–66, *Jan.*, 1942.—[See Abstr. 922 (1941)]. It is shown that the theorem stated in Born's paper [Abstr. 1354 (1940)], and proved for the case of a linear lattice of N equal particles under certain restrictions concerning the forces between the particles, that macroscopic stability (stability for long waves) implies microscopic stability, may be extended to 3 dimensions for the particular case of a face-centred cubic lattice, where the effects of all neighbours, other than the first 12 neighbours, are neglected.

638 548 : 539.3

On the stability of crystal lattices. VIII. Stability of rhombohedral Bravais lattices. PENG, H. W., AND POWER, S. C. *Proc. Camb. Phil. Soc.*, 38, *pp.* 67–81, *Jan.*, 1942.—[See Abstr. 637 (1942)].—The main purpose of the paper is an investigation of the stability of a certain class of Bravais lattices, namely those with a rhombohedral cell of arbitrary angle. The potential energy is assumed to consist of 2 terms, each proportional to a reciprocal power of the distance. In the continuous series of lattices, obtained by changing the rhombohedral angle, there are included the 3 cubic Bravais lattices, the simple (*s*), the face-centred (*f*) and the body-centred (*b*) lattices. It is shown that (*f*) and (*b*) correspond to a min. of the potential energy, and (*s*) to a max. A method for calculating the potential energy for the intermediate rhombohedral lattices is developed, and, with the help of a certain characteristic function, it is shown by numerical calculation that the (*f*) lattice corresponds to the absolute min. of potential energy, and that no extrema, other than (*f*), (*s*) and (*b*), exist. The case of a compound (non-Bravais lattice) is considered, and it is shown that the equilibrium and stability conditions for the law of force assumed can be divided into one set for change of volume, and an independent set for change of shape.

639 548 : 539.3

On the stability of crystal lattices. IX. Covariant theory of lattice deformations and the stability of some hexagonal lattices. BORN, M. *Proc. Camb. Phil. Soc.*, 38, *pp.* 82–99, *Jan.*, 1942.—[See Abstr. 638 (1942)]. The theory of lattice deformations is presented in a new form, using the tensor calculus. The case of central forces is worked out in detail, and the results are applied to some simple hexagonal lattices. It is shown that the Bravais hexagonal lattice is unstable but the close-packed hexagonal lattice stable. The elastic constants of this lattice are calculated.

See Abstr. 607 548.5 : 541.183.59

See Abstr. 392 548.526 : 536.421 : 532.612.3

640 548.7

The crystal structure of melamine. HUGHES, E. W. *J. Amer. Chem. Soc.*, 63, *pp.* 1737–1751, *June*, 1941.—The crystal structure of melamine was investigated. A new method for refining parameters, based upon least squares, is described and was used in conjunction with Fourier syntheses to locate the atoms. The packing of the molecules is dominated by hydrogen bonds. The properties of the compound are discussed briefly in relation to the structure and the empirical resonance energies of melamine and other cyanuric derivatives are calculated from data in the literature and compared with quantum-mechanical calculations.

641 548.7

The crystal structure of the urea–hydrogen peroxide addition compound $CO(NH_2)_2 . H_2O_2$. LU CHIA-SI, HUGHES, E. W., AND GIGUÈRE, P. A. *J. Amer. Chem. Soc.*, 63, *pp.* 1507–1513, *June*, 1941.

GEOPHYSICS

642 550.34 = 956

On the Itoigawa–Sizuoka tectonic line in the Minamikoma district, Yamanasi Prefecture, Japan. IZIRI,

S. *Bull. Earthq. Res. Inst., Tokyo*, 18, *pp.* 340–343, *June*, 1940.

643 550.34

New Madrid earthquake craters. MORSE, W. C. *Bull. Seism. Soc. Amer.*, 31, *pp.* 309–319, *Oct.*, 1941.

644 550.34

Seismic investigations in the Boulder Dam area in 1940. MEAD, T. C., AND CARDER, D. S. *Bull. Seism. Soc. Amer.*, 31, *pp.* 321–324, *Oct.*, 1941.

645 550.34

Progress report for 1940 of the United States coast and geodetic survey in the western United States. ULRICH, F. P. *Bull. Seism. Soc. Amer.*, 31, *pp.* 335–344, *Oct.*, 1941.

646 550.341

On dispersion of Rayleigh waves from the North Pacific earthquake of November 10, 1938. LISLE, J. F. DE. *Bull. Seism. Soc. Amer.*, 31, *pp.* 303–307, *Oct.*, 1941.—Rayleigh waves from the N. Pacific earthquake of Nov. 10, 1938, have been investigated in different azimuths for dispersion. Using dispersion curves of Jeffreys based on the hypothetical structure of a single crustal layer, the average thickness of this layer along great-circle paths from Bering Sea to each observatory has been calculated. The values found give a comparison between Pacific and continental crustal structure which affords confirmation of other evidence on this point.

647 550.341

The Ogasima earthquake and its aftershocks. HAGIWARA, T. *Bull. Earthq. Res. Inst., Tokyo*, 18, *pp.* 252–264, *June*, 1940.

See Abstr. 407 550.341 : 534.213

648 550.361

The thermal state of the earth. JEFFREYS, H. *Amer. J. Sci.*, 239, *pp.* 825–835, *Nov.*, 1941.—The available data related to the internal heat of the earth are reviewed. From these considerations it is concluded that: (1) The average radioactivities of surface rocks show a steady decrease with increase of density, though there is much scatter within a given type; (2) heat generated at depths up to 300 km. or so has had sufficient time to approach a state where it is conducted out as rapidly as it is produced; (3) nothing in the new results encourages the hope that fusion temperatures are a normal feature at any depth within the crust. (4) The thermal contraction available for mountain formation remains essentially unchanged except that a more uniform rate is suggested.

649 550.385

The great spot group and magnetic storm of September, 1941. NEWTON, H. W. *Observatory*, 64, *pp.* 161–165, *Dec.*, 1941.

650 550.385

The severe magnetic storm of September 18, 1941. RANGASWAMI, M. R., AND CHAUBAL, A. S. *Curr. Sci.*, 10, *pp.* 432–433, *Oct.*, 1941.

See Abstr. 493 550.385 : 537.591.5

651 550.389

Magnetic surveys of volcano Asama. II. MINAKAMI, T. *Bull. Earthq. Res. Inst., Tokyo*, 18, *pp.* 178–251, *June*, 1940.

652 551.21 = 956

Minor activity of volcano Sakura-zima in October, 1939. TSUYA, H., AND MINAKAMI, T. *Bull. Earthq. Res. Inst., Tokyo*, 18, *pp.* 318–339, *June*, 1940.—On Oct. 26, 1939, an eruption broke out at Sakura-zima, an active volcano in the northern part of Kagosima Bay, southern Kyûsyû. The activity lasted for about 2 weeks, during which period explosions were observed more than 200 times from Arimura on the southern foot of the volcano, and 44 volcanic earthquakes were recorded by the seismometer at the Kagosima meteorological station. The eruption occurred on the eastern flank of Minami-dake (south cone), about 500 m. from and 300 m. below the top of the volcano, where a pit-crater, about 25 m. across and 30 m. deep, was newly opened. Incandescent lava blocks, together with accessory rock-fragments, were not only scattered around the crater as volcanic ash, lapilli and bombs, but also descended *en masse* as a hot volcanic avalanche from the crater for a distance of about 700 m. The writers visited the volcano and studied the results of the eruption at the middle of December, the same year, when the new crater was almost completely inactive, except for 2 weak dumaroles on the crater-wall. A summary of the events during the activity is given, together with the results of geological observation and magnetic survey of the volcano, and petrographical notes of the juvenile ejects.

See Abstr. 653 551.46 : 551.5

653 551.5 : 551.46

The ocean's influence on weather. CALLENDAR, G. S. *Quart. J. Roy. Met. Soc.*, 67, *pp.* 383–384, *Oct.*, 1941.

654 551.5 : 8

The scenic approach to meteorology. BONACINA, L. C. W. *Quart. J. Roy. Met. Soc.*, 67, *pp.* 305–313, *Oct.*, 1941.

655 551.506.3 : 551.582.2

The Durham meteorological record, 1847-1940. MANLEY, G. *Quart. J. Roy. Met. Soc.*, 67, *pp.* 363–380, *Oct.*, 1941.

656 551.506.5

Some meteorological observations in the Libyan desert. DURWARD, J., AND PEEL, R. F. *Quart J. Roy. Met. Soc.*, 67, *p.* 314, *Oct.*, 1941.—Errata.

657 551.506.7 = 3

Investigation of a cold-air irruption by a series of kite ascents. FOITZIK, L. *Met. Z.*, 57, *pp.* 115–119, *March*, 1940.—A preliminary report on a series of 22 kite ascents made at Lindenberg between 15th and 19th June, 1938. Although the ground temperatures were const., with exception of one night of frost, the temperatures at 600 mb showed considerable differences. Inversion layers on top of the clouds, temperatures and rel. humidities, were observed during ascents and descents. R. N.

658 551.508.41

A new electrical weight barograph. PATTERSON, J., AND MIDDLETON, W. E. K. *Quart. J. Roy. Met. Soc.*, 67, *p.* 362, *Oct.*, 1941.

659 551.509.311 = 3

The pressure-change regions of the 500 mb surface as applied to forecasting. SCHMIDT, G. *Met. Z.*, 57, *pp.* 26–32, *Jan.*, 1940.—Isallobarics for 24 hr. periods, drawn from observations in the 500 mb surface, were analysed, with special reference to the speed of propagation of disturbances, the conditions in which the ground cyclone becomes stationary, and the method of early recognition of a new disturbance. Examples are given and anticyclones are briefly discussed. R. N.

660 551.510.3 : 551.524.4 = 3

A method for observing the vertical gradients of density and temperature in the upper atmospheric layers. BROCKS, K. *Met. Z.*, 57, *pp.* 19–26, *Jan.*, 1940.—Fluctuations of light beams due to varying refraction are shown to be a direct measure of the changes in the vertical density gradient and may therefore be used for investigating the temperature stratification or changes in the isobaric-isosteric solenoid field. Relations are established between changes in the radius of curvature of the beam and the fluctuations of the meteorological elements at a certain point, and between the average meteorological changes along the beam and the beam fluctuation at the point of observation. Examples are given based on measurements made in the sub-alpine atmosphere. The absolute value of density and temperature gradients was determined by simultaneous measurements from both ends of the beam. [See Abstr. 1403 (1930)]. R. N.

661 551.511 = 3

Contribution to the definition of equivalent and moist temperature. BLEEKER, W. *Met. Z.*, 57, *pp.* 111–115, *March*, 1940.—Pseudo-isobaric and isobaric equivalent temperatures are defined with respect to elimination or retention of the condensate. Similarly, pseudo-isobaric and isobaric moist temperatures are defined, and relations are established between equivalent and moist temperatures. Isobaric and pseudo-isobaric temperatures are not the same as adiabatic and pseudo-adiabatic temperatures. A bibliography is given. [See Abstr. 2031 (1941)]. R. N.

662 551.511 = 3

On the theory of moist adiabatic changes of state. PAUL, M. *Met. Z.*, 57, *pp.* 33–37, *Jan.*, 1940.—From the fact that the sum of all entropy changes = 0 in an adiabatic process the author derives an exact expression for a reversible moist adiabatic change of state as one ideal boundary case. A similar expression is derived for the case of the pseudo-adiabatic, in which the condensate is removed at once. The results are compared with those of Fjelstad. The general case, intermediate between the above boundary cases, is investigated and an approx. formula is obtained which is frequently used [see Abstr. 2566 (1941)]. R. N.

663 551.511 = 3

The origin of the 0° isothermy and the formation of fractocumuli below nimbostratus. FINDEISEN, W. *Met. Z.*, 57, *pp.* 49–54, *Feb.*, 1940.—In curves of atmospheric structure obtained by upper-air measurements 0° isotherms of various heights are frequently observed, sometimes of several hundred metres if no general vertical rise of the air occurs. The isothermal zone is not extensive if an originally moist stable gradient prevails, and is formed at the lower boundary of nimbostratus (Ns), owing to the melting of snow particles. Saturation in the layer below the Ns causes the formation of fractocumuli which may tend to swell up through the Ns, and in this region icing on aircraft will occur and squalls are likely. The ordinary fractocumuli formed in the melting zone usually allow of at least partial ground visibility. R. N.

664 551.511 = 3

On the formation of concepts in meteorology in general, particularly the concept of steering, and the regulation by atmospheric pressure phenomena. NOTH, H. *Met. Z.*, 57, *pp.* 99–106, *March*, 1940.—Generally speaking, steering only affects the direction of a moving body, not its speed, and therefore involves but little energy. In meteorology "steering" also implies a change of speed of the atmospheric masses. Thus pressure phenomena in the stratosphere are capable not only of steering but also of driving. The energy required is derived from thermic flow. The position of the tropopause has a definite effect on the pressure distribution at the ground and acts as a regulator. This is due to the coupling between the isobaric field and the flow, circulation and changes in height, of the upper troposphere and the tropopause. The observation of flow at great heights may give a clue to the general weather situation and lead to new methods of long-period forecasting. R. N.

665 551.511 : 551.57 = 3

Heat content (enthalpy), equivalent temperature, and evaporation or condensation. SCHNAIDT, F. *Met. Z.*, 57, *pp.* 6–11, *Jan.*, 1940.—The author derives a formula by which the equivalent temperature is defined as a measure of the enthalpy of moist air. This is compared with a formula previously derived by Linke, and the differences are discussed. The formula is applicable to the evaporation in psychrometers, heat loss in breathing, mixing of moist air of different humidity, etc. R. N.

666 551.515

An investigation concerning G. I. Taylor's correlation coefficient of turbulence. SCHUMANN, T. E. W. *Phil. Mag.*, 32, *pp.* 471–482, *Dec.*, 1941.—The autocorrelation coefficient between the measured value of a variable and its value some time later is examined. An analytic expression for the coefficient is derived, and Taylor's deduction, viz. that when developed as a power series, the coefficient involves only even powers of the time, is shown to be not of universal application. For molecular velocities the coefficient is of exponential form, as it is also (on certain reasonable assumptions) for barometric pressures, atmospheric temperatures, and turbulent velocities. The coefficients are calculated for certain meteorological data and are shown to agree well with the theoretical values. A. HU.

667 551.515.4 (54)

Kalbaishakhis (Thundersqualls) of Bengal. GUPTA, P. K. S. *Sci. and Cult.*, 7, *pp.* 134–139, *Sept.*, 1941.

668 551.524.32 = 3

The beginning of summer singularities in Central Europe. HOFMANN, A. *Met. Z.*, 57, *pp.* 11–18, *Jan.*, 1940.—Observed temperatures are compared with the ideal temperature curve as calculated from measurements at Potsdam 1893–1936; and the average deviations are represented for a complete year, with special emphasis on the summer values. The different years are grouped according to type, characterized by the more or less regular phenomena of the summer monsoon. R. N.

See Abstr. 660 551.524.4 : 551.510.3

669 551.524.7 = 3

Symmetries and periods in the variation of barometric average temperature in the lower half of the troposphere. WAHL, E. *Met. Z.*, 57, *pp.* 1–5, *Jan.*, 1940.—The variation of the symmetry indices for the barometric average temperature $T_m = \Delta Z/198{\cdot}80$ is determined by the method previously explained [Abstr. 2560 (1941)]. ΔZ being the relative topography of the 500 mb surface measured in dynamic decametres. Observations from ascents made at Hamburg between Sept., 1937, and Feb., 1938, show a predominating asymmetric wave of 27 days' duration. For the attempt to explain this phenomenon previous investigations are taken into account, which showed that, with increasing temperature differences between the arctic cool air and the warm air of the temperate zone, heat accumulation occurs at the polar front and this leads to a periodical "dropping off" of the cold air when a critical value of the temperature difference is reached. R. N.

670 551.542.1 = 3

Local differences and time variation of the density strata in mountain air. BROCKS, K. *Met. Z.*, 57, *pp.* 62–73, *Feb.*, 1940.—The method previously described [Abstr. 660 (1942)] was used for measurements carried out between sub-alpine mountain stations in Upper Bavaria. Additional measurements were made between these stations and some stations in the plain. The diurnal variation in density gradient was observed and the results compared with those previously obtained. The decrease in the rate of lapse at midday in the neighbourhood of mountain slopes agrees with the results obtained from wind measurements. R. N.

671 551.551 : 551.594.2

Air-currents in a lightning storm. SHIPLEY, J. F. *Quart. J. Roy. Met. Soc.*, 67, *pp.* 340–345; *Disc.*, 350–361, *Oct.*, 1941.—The author outlines the air-currents existing in tropical thunderstorms. Moist air heated by contact and radiation from a sun-warmed surface rises up the centres of hexagonal cells, cools to the dew-point or below, and falls down their sides. Such a cell growing rapidly will contain a central column ascending and rotating rapidly, the local air being caused to revolve as a collar vortex. Subsidiary internal cells developing unequally produce the condition usually described as turbulence. The bearing of this model on the formation of hailstones is discussed. A. HU.

672 551.553.11

The land-breeze of autumn and winter in north-west England. HAWKE, E. L. *Quart. J. Roy. Met. Soc.*, 67, *pp.* 381–383, *Oct.*, 1941.

See Abstr. 665 551.57 : 551.511

673 551.576.11 = 3

Lenticular clouds and local discontinuity surfaces. EXTERNBRINK, H. *Met. Z.*, 57, *pp.* 55–61, *Feb.*, 1940.—The formation of lenticular clouds, especially in laminar groups, are investigated. These forms are not dependent on geographical features, such as the neighbourhood of mountain barriers, but may occur at any surface of discontinuity due to inversion and abrupt change of wind. Such local discontinuities are mainly due to turbulence in the free interspaces. Up to 5 of these clouds, one on top of the other, have been observed. They may cause vertical movement throughout the troposphere, and this accounts for the success of a glider flight at more than 9 000 m. R. N.